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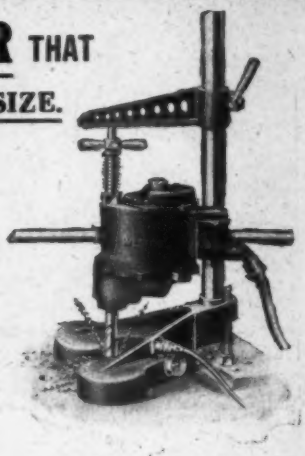

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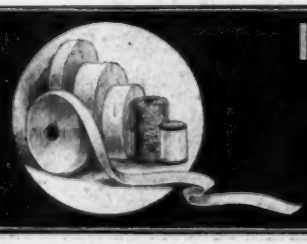

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VOL. LXXXIX. NOVEMBER 25, 1921. No. 2,296.

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ELECTRICAL SALESMANSHIP CONFERENCES.

THE large attendance at the first of the series of informal discussions on salesmanship which have been organised by the E.D.A. is a good augury for the success of those which are to come. The meeting, which is reported on another page, was held in the hall of the Chartered Insitute of Patent Agents, which proved to be none too large. Both contractors and supply authorities were well represented, and the informal manner in which the meeting was conducted set everybody at ease from the start. The growing popularity of informal meetings is little to be wondered at, and the absence of the restraint which is too often apparent at the more formal meetings of some of our institutions was, in this particular case, very noticeable. There was no dearth of speakers; in fact, the eagerness of some of those present to express their views and recount their experiences could almost be described as competitive. Many of the experiences recounted were not only interesting, but amusing, and one could not help feeling how delicate and intricate the business of selling really is.

Although the subject under discussion was electrical salesmanship, many of those present, as will be seen from the report, digressed a little, and took the opportunity to air their grievances. The suggestion made by the contractors that the supply authorities could do more for them, was met by the assurance that the supply authorities, for the most part, were anxious to co-operate; indeed, it was to their advantage to do so, but it was pointed out on their behalf that they also had to run their undertakings on business lines. Both the Chairman (Mr. S. T. Allen) and Mr. Beauchamp, the Director of the E.D.A., reminded the meeting that the subject under discussion was salesmanship, but on the whole the digression was excusable. It was evident, however, that relations between contractors and supply authorities generally are quite friendly, and that as the industry develops, so will the spirit of co-operation grow. The value of the series of conferences cannot be over-estimated, and as an indication of the interest which has been aroused, it may be mentioned that the desirability of obtaining a larger room is already under consideration. The suggestion was also made that the meetings might start earlier, in order to leave more time for discussion, and Mr. Beauchamp promised that this would also be considered. The arrangements for the next meeting, however, will have to stand.

Much that was said at the first conference was elementary, but it is, nevertheless, fundamental, and only a complete appreciation of the fundamentals of the whole art of salesmanship in electricity supply can achieve the desired result. Happily, there is now much more prospect of "push and go" on the part of contractors, for the relationship between them and the electricity supply authorities is now very different to what it was a few years ago. Without whole-hearted co-operation between the electrical contractors and the supply authorities, little can be hoped for. One of the greatest drawbacks in this matter is the question of mains. Too often there have been long and learned arguments as to how electricity supply should be increased and the great field there is for it, but insufficient attention has been given to the fact that in parts where there is a great potential demand, there are no mains. Hence

all the arguments in the world are unavailing if the prospective consumer cannot get the supply, and some of the efforts of the manufacturers to turn out cheap apparatus, and the contractors to induce people to use them, will be wasted until greater attention is paid to this subject. The difficulties now, of course, in laying mains on anything approaching a speculative basis are obvious. At the same time, in London alone there are hundreds and even thousands of streets of quite good class houses where a considerable amount of business would undoubtedly be obtained if the mains were laid. In many cases no attempt has been made to ascertain whether residents desire a supply, and when they approach the Department they only meet with discouragement. It is satisfactory, therefore, to find, almost for the first time, that this aspect of the problem which is facing us is fully appreciated. Closely bound up with that comes the question, Who is to do the wiring? Where the person is not the owner of the house he naturally will not incur the expense, and the landlord will, in the majority of cases, also refuse. Therefore, it is a wise suggestion to concentrate on the householder who is also the owner. A larger percentage of owners are occupiers than ever before, owing to recent property transactions. All this emphasises the difficulties that have to be faced; yet there is much to be done even where mains are laid. This is the part of the work which must be tackled first.

Local Authorities and the Supply of Fittings.

The case of Attorney-General *v.* Liverpool Corporation, which was decided last week by Mr. Justice Russell, involved the discussion of a new and interesting problem in connection with municipal trading. A perusal of the judgment of the learned judge, which is printed at length elsewhere in this issue, shows that although a local authority may not originally have had power to provide, sell, &c., electrical fittings, it may acquire this important privilege by taking over the rights and powers of a statutory company. It appears that the Liverpool Corporation in 1896 and in 1902 acquired, by Act of Parliament, the undertakings of two companies which had the right to manufacture and supply fittings, and Mr. Justice Russell has held that this right was transferred to the Corporation, and that there was no rule of the common law relating to corporations which prevented the exercise of this power. Having distinguished the case of Attorney-General *v.* Sheffield Corporation, in which it was held that in the absence of statutory authority undertakers who are a local authority cannot provide lamps, fittings, motors, or apparatus other than meters, the learned judge went on to point out that on the evidence before him, the Liverpool Corporation had in fact made a profit which enured to the benefit of the ratepayers. We confess that it is not easy to understand why the question whether the business was profitable or not was relevant. If the learned judge was right—and we would be long sorry to question his finding—in holding that the Liverpool Corporation stepped into the shoes of the two companies, the question whether the business was profitable or not does not seem to be very material. But there was another point decided by the learned judge upon which he was fain to confess that he pronounced after much consideration. The Electricity Supply Act, 1919, provides that a local authority may provide, let on hire, repair and maintain fittings and apparatus, but it provides in parenthesis that it shall not, unless expressly authorised by special Act or Order, "manufacture or sell." Mr. Justice Russell held that the necessary express authority to do this was to be found in the Act of 1896, which gave the Corporation all the rights and privileges of the Liverpool Company. In the result he dismissed an action which had been brought at the instance of certain ratepayers who sought a declaration that the Corporation was not entitled to carry on this form of municipal trading.

It has, of course, been decided that the Electric Lighting Acts do not authorise undertakers to supply electric fittings and apparatus other than meters.

The result of this case is somewhat remarkable. It seems that although the Liverpool Corporation has never been directly authorised to act as provider and vendor of electrical fittings, it has acquired this important power by virtue of private arrangement, confirmed by Act of Parliament, with companies which had these powers. Hitherto power to sell and let fittings has only been conferred by Statute. Thus it is common to find in the Acts of local authorities a special clause to enable them to sell, let, hire, but not to manufacture, lamps, meters, electric fittings, &c. The terms of these clauses vary somewhat. In the Nottingham Corporation Act, 1889, Sec. 4, the power conferred is to provide and let, &c., but not to manufacture, "lamps, meters, electric lines, fittings, apparatus and things, for lighting and motor power, and for all other purposes for which electric energy can or may be used, or otherwise necessary or proper for the supply, distribution, consumption, or use of electrical energy." The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: "Electrical motors, and apparatus for the use of electricity for motive power and other purposes."

The Halifax Corporation Act, 1898, is even wider in its terms. It authorises the Corporation to "purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, burners, arc and other lamps, fittings, wires, plant, engines, conductors, machinery, apparatus, and appliances for and in relation to," &c.

The London County Council (General Powers Act, 1906) confers certain general powers on Metropolitan boroughs supplying electricity, but expressly withholds power to *manufacture* fittings.

We do not gather, however, that Mr. Justice Russell's decision will enable a local authority exercising its statutory power of purchase pursuant to Sec. 2 of the Electric Lighting Act, 1888, to acquire the right to "manufacture or sell." This was expressly reserved by the Act of 1919, and can only be enjoyed by virtue of a "special Act or Order." The Act of 1888, which gives the right to purchase, is certainly not a special Act or Order.

While, therefore, the case under notice may not lead either directly or immediately to what is regarded in some quarters as a very undesirable form of municipal trading, it is manifest that other local authorities, which have taken over the undertakings of other supply companies, may find themselves vested with power to sell and manufacture electrical fittings. We may be permitted to wonder whether when the Bill which became an Act in 1896 was before Parliament, any of those who opposed it were aware of the powers about to be conferred on the Corporation. If it does nothing else, the case which we have considered should serve to draw the attention of those who supply fittings to the activities of the local authority which may be seeking to acquire the undertaking of the existing supply company.

The Profits of the A.E.G.

As will be seen from our "City Notes," the directors of the Allgemeine Elektrizitats Gesellschaft, of Berlin, have resolved to pay a dividend at the rate of 16 per cent. for the year 1920-21, being an increase of 2 per cent. over the preceding year. The question was referred to in the *Daily Telegraph* last Saturday in a despatch from its Berlin correspondent, who seems to be enthusiastic concerning what he terms the "company's abounding prosperity." To those who for many years past have followed the fortunes of the A.E.G. and are familiar with its accounts, it is something remarkable to hear from the Berlin correspondent about this great degree of prosperity under the existing circumstances of German currency. If the correspondent had

taken the trouble to consult one of the German works of reference at his disposal and ascertained the profits and dividends paid by the company in former years, when the mark was at par value, he would not have indulged in the phrase of "abounding prosperity."

The company's annual report, however, has not yet been issued; as usual, only a summary of the financial results is sent out by the directors in the first place, and what does this summary show? Curiously enough, the correspondent omits to quote the net profits earned by the company, which are returned at 82,388,686 marks, as compared with 45,707,352 marks in the preceding year. Now the former amount at the present rate of exchange of, say, 1,000 marks to the pound sterling, merely represents £82,388. Even if the sum of 100,000,000 marks (£100,000), which has been placed to the formation of a reserve account for works' maintenance, is added to the net profits, the position by no means bears out the assertion as to prosperity.

But let us examine the question a little more closely and as compared with former years. If we refer to the company's accounts for the last year of former peace (1913-14), it is found that the net profits amounted to £944,000 sterling, of which £775,000 was distributed in the form of a dividend at the rate of 10 per cent. It will be seen that the company paid away in dividends in the last year of the former peace period nearly ten times the amount of the actual net profits realised in 1920-21. If the first two years of the war are taken into consideration, when the mark was still at about par value, the net profits in each exceeded £1,000,000 and the rates of distribution were higher than in 1913-14.

The time seems to have arrived to protest against the exaggerated statements published in English newspapers concerning the alleged high degree of prosperity in Germany. Such assertions, it is true, are not limited to any one newspaper. That a large amount of business is being transacted by German industrial works as a whole is a matter which it is not our intention to dispute; but it is merely a sham condition of prosperity based upon an enormously inflated currency. The limits in these directions will probably soon be reached, and the consequences may be extremely disastrous not only to those directly concerned, but also to the rest of Europe.

The Future of China.

In compressing into a comparatively short report, which we abstract on another page to-day, a survey of the salient features of China's economic history during 1920 and the first half of the current year, H.M. Commercial Counsellor at Peking, Mr. H. H. Fox, has performed a difficult task with care and skill. The report does not make light of China's troubles, but it confirms the views which have been expressed in these pages for ten years and more that the country will ultimately fully repay the most assiduous cultivation by the British engineering exporter.

The record trade figures of 1920 are hardly a matter for congratulation from China's point of view, for after a series of years in which the value of her export trade gradually crept up until it reached in 1919 a point only 16 million taels short of her imports, last year brought an adverse trade balance amounting to over 220 million taels. It was, however, a year of revolution, famine and devastation to crops through typhoons. China's historic tea trade practically ceased. Yet its place was taken by other active exports, *e.g.*, minerals, coal, cereals, and tobacco. And meanwhile machinery and materials for the country's growing industries were imported in steadily increasing quantities. This circumstance is of especial interest to the engineering trades, and in conjunction with other tendencies it confirms Mr. Fox in the belief that China is one of the greatest undeveloped markets of the world, and is destined in the fulness of time to take a place among its great industrial nations. Despite China's disastrous experiences during the period covered by Mr. Fox's report, despite lack of communications and neglect of the scientific development of her vast natural resources, he is of opinion that the country is on the eve of a period of unexampled commercial and industrial development which will in a few years bring about a complete change in her economic situation.

At a recent gathering of the Rotary Club in London, Mr. Chao-Hsin Chu, Chargé d'Affaires, in referring to the commercial opportunity in China, said that the market was open to the world in general and to Great Britain in particular. He urged England to do more to induce Chinese students to come to English colleges and universities. America provided means and facilities in such a direction, with the result that there were over 2,000 Chinese students in her colleges and universities as compared with only about 250 in similar institutions in England. We have on many occasions dwelt upon the importance of this matter, and would once more urge British manufacturing and educational authorities, as well as the Department of Overseas Trade, to bear in mind the importance of the subject from the future international trade standpoint.

Telephone Line Work.

Although in this country the telephone service is enclosed in a watertight compartment, the conditions under which it is organised and conducted are fundamentally similar to those which obtain in the United States; the technique of the art, however, has followed widely divergent lines in the respective countries. One factor which has exercised great influence on trans-Atlantic practice is the immensely greater development of the public telephone service in the United States, where no fewer than 12,600,000 stations are connected to one vast system, in addition to 900,000 stations owned by independent companies.

Under the circumstances it is reasonable to suppose that we in this country have a great deal to learn regarding telephone work from our American cousins, and Mr. E. S. Byng, whose I.E.E. paper is abstracted elsewhere in this issue, has rendered excellent service to British telephone engineers by placing before them a unique and invaluable account of his observations made during a recent visit—an account which abounds in technical detail and is well illustrated with admirable drawings. We regret that we are unable to devote more space to the paper; every telephone engineer ought to possess a copy of the original in its complete form as a technical handbook. We have, however, by the courtesy of the author, been enabled to reproduce a number of photographs selected from the 52 views which he showed to the members of the Institution last week, in order to convey some idea regarding typical aspects of American telephone practice. We should add that the paper will be found of interest and value also to electric power engineers in many respects.

Mr. Byng, who is now on the staff of the Western Electric Co., Ltd., was formerly employed by the National Telephone Co., and afterwards by the Post Office, and his thorough acquaintance with British practice enabled him to identify the numerous points in which America methods differ from ours.

We are bound to refer in particular to the human side of his observations. He says: "Throughout . . . there appears to be a keen spirit of 'Service First' so that the public shall have no legitimate ground for complaint. . . . The ready acceptance of machinery and labour-saving devices by the working man, and the fact that they have been used to their full capacity, have been conducive to high efficiency. Trade unionism exists to some extent, but there is no desire to hamper output. . . . Any position in the Bell system is open to anyone who becomes qualified for it." These are admirable principles, all tending towards *efficiency*. We have equally good material in our own telephone service, but it is not used to anything like the same degree of efficiency, and it never can be so used, under the conditions obtaining in a State department, controlled by political considerations and with promotion regulated by seniority. In fair competition, private enterprise wins hands down every time.

F.

ONE SOLUTION OF THE FREQUENCY PROBLEM.

By C. SUTTON, A.M.I.E.E.

Neglecting such cases as those of the North-East Coast, Birmingham, and certain railways, which are bound to other but moderately satisfactory frequencies, the 50-period, three-phase system is now the European standard system of supply. There are, however, in Great Britain the following plants operating at undesirable non-standard frequencies, and mostly single-phase; in some instances there is a direct-current traction supply from the same station:—

TABLE I.—*Number of British Stations generating at periodicities other than 50.*

Periodicity.	No. of Stations.	Periodicity.	No. of Stations.
100 cycles	9	80 cycles	2
98 cycles	1	77 cycles	1
90 cycles	2	75 cycles	1
85 cycles	2	68 cycles	1
83 cycles	3	60 cycles	10

(There are also one or two 40-cycle and 25-cycle stations in 50-cycle districts.)

In nearly all these cases immediate or ultimate possibilities of linking-up and the intrinsic advantages of the standard system dictate that the latter shall be adopted in all future extensions of both plant and distribution network, and that the existing network and load shall gradually be changed over.

Let us consider the problem presented when plant extensions are required in one of these stations. The new unit should preferably be able to deal with the normal day load in order that improved economy may be realised by using the relatively inefficient existing plant for stand-by and peak-load purposes only. On the other hand, the development of the 50-period, three-phase mains and load, and the change-over of the existing non-standard distribution system can only take place gradually during perhaps a decade or more. Especially at the present time is it desirable to defer large capital expenditure.

Initially, therefore, the new set will have only a small three-phase load, and to enable it to be loaded up by, and to supply, the old network, a frequency changer must be installed of nearly the same capacity.

In time the three-phase load will grow, and eventually preponderate, but for many years there will be a considerable special-frequency load which will have to be dealt with either by obsolete generating plant or through a large frequency changer.

Clearly, what is required is a turbo-alternator unit which can generate its full output at either frequency or at both simultaneously, and it is the purpose of this article to examine a method which achieves this with minimum expense and conversion losses.

A double-rotation turbine set is used, one alternator being built for 50 periods and the other for the original station frequency. In the normal double-rotation turbine set, the two alternators are, of course, permanently connected in parallel, the speed of only one alternator being governed. In the proposed set, the speed of the single-phase alternator will be governed, but it will be impossible to connect two alternators of different frequencies in parallel and thus keep the speeds of the two ends in synchronism. The three-phase, 50-period, turbine-driven alternator stator will be connected permanently to the stator of a 50-period, three-phase synchronous machine, whilst the single-phase high-frequency turbine-driven alternator stator will be connected permanently to the stator of a single-phase high-frequency synchronous machine. These two synchronous machines will be designed to run at some moderate common synchronous speed, and will be direct coupled to each other mechanically, so that they constitute what is hereinafter referred to as a "synchronous coupler set."

The turbine set and the synchronous coupler set are run up to speed together, the two 50-period machines

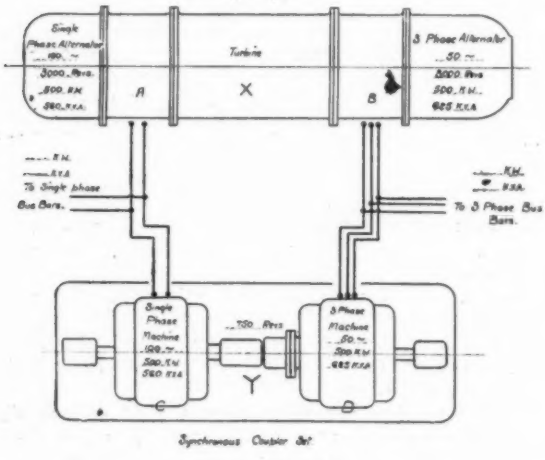


Fig. 1.

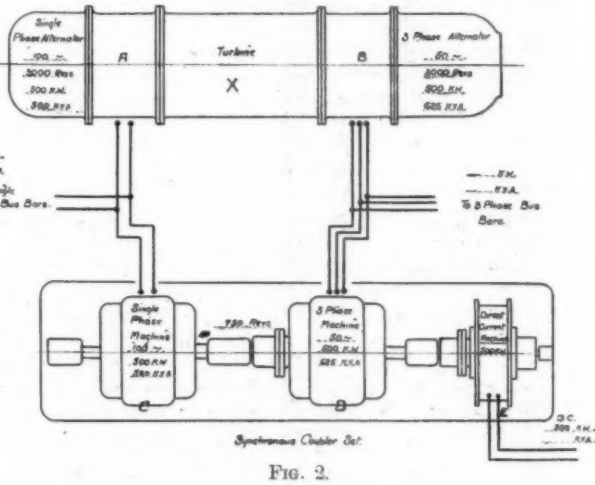


Fig. 2.

running in parallel, and the other two machines running in parallel also, and as the correct speed of one of the turbo-alternators is maintained by the governor, the "sister" turbo-alternator must run at its correct synchronous speed owing to the mechanical and electrical coupling effects of the synchronous coupler set. It would be advantageous to provide separate excitation for the two machines comprising the coupler set, and also for the field of the turbo set exciter, to ensure that the four machines will come into step at a minimum speed.

As an example, assume that the present load on a certain power station is a maximum of 1,000 kW, single-phase, 100 periods, power factor 0.9, with a gradually increasing three-phase, 50-period load, and that it is the intention of the power-station authorities to change over the single-phase, 100-period load to three-phase, 50-period load by degrees. Fig. 1 shows a combined set for dealing with these conditions. "X" is a double-rotation turbine unit, "A" alternator being a 4-pole machine designed for single-phase, 100 periods, and capable of an output of 500 kW with a power factor of 0.9. "B" alternator is a 2-pole machine designed for 3-phase, 50 periods, and an output of 500 kW, with a power factor of 0.8. Both these alternators must run at 3,000 r.p.m. to give their designed frequency. "Y" is a synchronous coupler set, consisting of two synchronous machines mechanically coupled together on the

same bedplate. The speed of this set is 750 r.p.m. "C" machine has 16 poles with a periodicity of 100, and is designed for an output of 500 kW at power factor 0.9 single phase. "D" machine has eight poles with a periodicity of 50, and is capable of an output of 500 kW at power factor 0.8 three-phase.

The stator windings of "A" and "C" machines and of "B" and "D" machines respectively are permanently connected in parallel. The connections to the

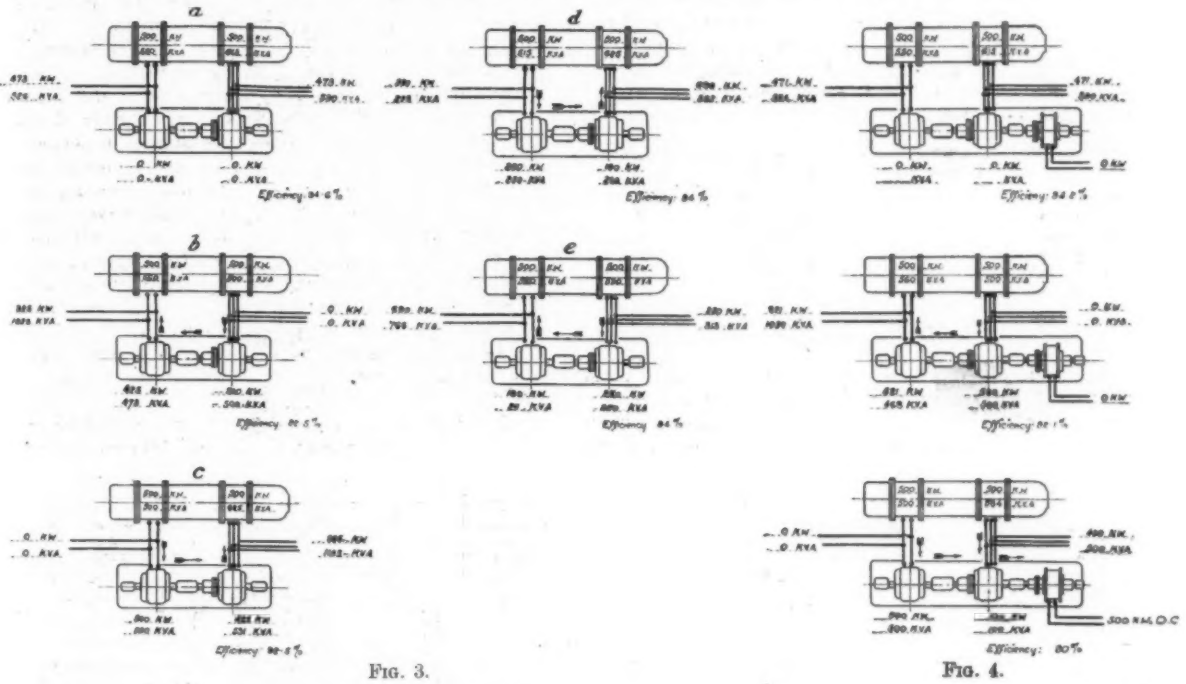


Fig. 3.

Fig. 4.

single-phase busbars are made from the leads connecting "A" and "C," and those to the 3-phase busbars from the leads connecting "B" and "D."

Now it will be evident that single- and three-phase load can be taken from this combination in any desired proportion up to the limiting output of the turbine, and in fig. 3 various examples of distributions of load are shown with the relative loadings on the synchronous coupler set. The efficiency given in each case is:—

$$\frac{\text{Single-phase + three-phase load.}}{\text{Total output of both turbo-alternators.}}$$

Comparing the two alternatives:—

(1) 1,000-kW, 3-phase turbo set with 1,000-kW frequency changer;
(2) 1,000-kW dual-frequency turbo set with 500-kW coupler set.

It will be evident that to obtain the same flexibility of supply, the output of the frequency changer must be double that of the synchronous coupler set (1,000 kW instead of 500 kW). Also, as regards efficiency, when the whole load is required at the non-standard frequency, it must all pass through the frequency changer, while with the synchronous coupler set combination, only half the load will have to be converted as a maximum.

Table II gives the relative efficiencies at the different proportions of load given in fig. 3 for a synchronous coupler and a frequency changer.

TABLE II.

	Outputs.		Efficiency.	
	100 cycle Single-phase:	50 cycle Three-phase.	Frequency Changer.	Synchronous Coupler.
(a)	473 kW	473 kW	91.4 %	94.6 %
(b)	925 kW	0	88 %	92.5 %
(c)	0	925 kW	91.5 %	92.5 %
(d)	250 kW	690 kW	91 %	94 %
(e)	690 kW	250 kW	90.5 %	94 %

Comparative efficiency between the frequency changer combination and the synchronous coupler set assuming in the former that 50 cycles is the primary periodicity.

The synchronous coupler scheme shows an appreciable gain in efficiency which is explained by the fact that the power passing through the converting medium is never more than half the power generated.

It will be evident that while periodicities of 100 and 50 have been taken as an example, any other combination of frequencies can be obtained. For instance, with 50 and 90 periods the four-pole alternator of the turbine set would run at 2,700, while the two-pole alternator speed would be 3,000 r.p.m. In this case the output from each alternator would be proportional to its speed.

With a 50-cycle-40-cycle combination, the two machines constituting the turbo set could be made exactly similar, but by coupling them electrically through the synchronous coupler set, the one machine would be held at 2,400 r.p.m.

A further development of the idea could be made where it was desired to supply direct current as well as the two periodicities. In this case a direct-current dynamo is coupled up to the synchronous coupler set, making a

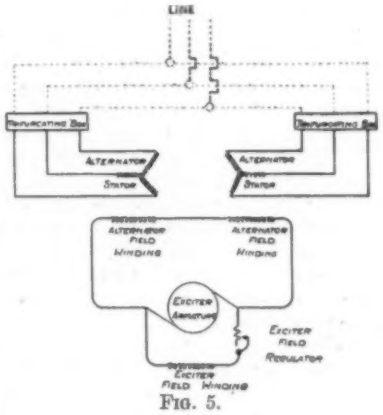


Fig. 5.

three machine combination, and the load can then be varied between the different systems in any proportion up to the limit of the turbine. Figs. 2 and 4 give an example of this. A direct-current machine of 500-kW capacity has been assumed, but this may be made of any size up to the limit of the turbine according to the amount of direct current required. The direct-current machine will automatically take its driving power from the more lightly loaded of the two turbo-alternators.

With the proposed arrangement of plant it is impossible to run the turbo set separately from the synchronous coupler set, as the latter is necessary to keep the two sides of the turbine at their correct speeds. It may be of interest to consider what alterations would be necessary to convert the turbo set to a standard 50-period combination, and also to enable the synchronous coupler set to be run as an ordinary frequency changer.

Turbo Set.—(*a*) *One alternator* 50 *periods. The other above* 60 *periods.*—The special alternator would be four polar in this case, and it would be necessary to replace this machine by a duplicate of the 50-period alternator.

(*b*) *One alternator* 50 *periods. The other* 60 *periods, or lower.*—The two alternators could be duplicates, as a transformer could be installed if necessary to transform the voltage. The set would then be standard, and could always be used as a 50-period machine.

Synchronous Coupler Set.—By adding a starting motor to the set it could be used as an ordinary frequency changer.

Considering the scheme from rather a different standpoint, it is a well-known fact that on turbine-driven alternators the power factor of the load has a considerable effect on the size of the machine, as the loading on the rotor increases very rapidly as the power factor decreases. As the machines composing the synchronous coupler set are permanently connected in parallel with the turbo-alternators, it is possible to arrange for them to take more than their share of the magnetising current, and thus relieve the turbo-alternators. On lower-speed sets it is much cheaper to provide the extra field strength necessitated by a low power factor than is the case on a high-speed alternator. In some instances, therefore, it would be possible with the proposed scheme to obtain a greater output from a given standard turbine set. Also it enables the set to be made approximately symmetrical mechanically by building the single-phase turbo-alternator for unity power factor and the three-phase machine for a power factor of 0.8.

References to divers adaptations to special cases are purposely omitted.

Summarising, the advantages to be obtained from the adoption of the synchronous coupler set are :—

1. Considerable gain in efficiency over usual methods, as in the worst case only half the power passes through the converter, and usually much less than this, while the light-load losses are much lower.
2. Saving in first cost.
3. Maximum flexibility.
4. Direct current can be obtained from the combined plant if necessary.
5. Simplicity. No starting motor, transformer, or synchronising gear between turbo set and synchronous coupler set.
6. Part of the wattless component of the load may be transferred from the high-speed alternators to the lower-speed machines, thus enabling an increased output to be obtained from a standard turbo set.

Note.—For the sake of those unfamiliar with the double-rotation turbine, it may be of interest to give a diagram of connections of the "Brush-Ljungström" turbo-alternator sets as ordinarily arranged (see fig. 5). The alternator stators are permanently connected together in parallel and the rotors in series.

The turbine consists of a number of blade rings concentrically arranged, and fixed on two turbine disks. The live steam enters at the centre of the turbine inside the innermost blade-ring, and from thence passes through the blade-rings outwards in a radial direction, the two disks running in opposite directions. To each turbine disk an alternator rotor is coupled. On starting up the set the two alternators automatically synchronise and thenceforward run electrically as one machine.

I beg to thank the Brush Electrical Engineering Co., Ltd., of Loughborough, for information regarding the "Brush-Ljungström" plant.

WHY THEY FIGHT.

By W. PHILLPOT.

The electrical wholesaler is undoubtedly having a very thin time at the present moment, worse even than his companions in misfortune, the manufacturer and the contractor. The struggle for existence on the part of the manufacturer is making him cut every fraction of costs he possibly can, and the result is undoubtedly a tendency to squeeze out the middle man. Whether this tendency be good or bad is not for me to say, but certainly it has had the effect of making the wholesaler sit up and take notice, and every business opportunity is now eagerly snatched at, or should be.

One of the chief stumbling-blocks in the way of business-getting with many firms of this type is often the lack of co-operation between the estimating department inside and the outside representative or travelling salesman, who is one of the most important units in the organisation of such firms. The writer hopes to point out in these notes a few of the snags on which business prospects are wrecked, with hints on avoiding them.

At the present time not the very faintest chance of a deal can be allowed to slip—and yet how very weary the inside man gets of continual quote, quote, quote in reply to inquiries with never the smallest sign of a bite to enliven the monotony! Experience, of course, soon teaches the estimator, by the way the traveller words an inquiry, whether there is any chance of an order, and the "why trouble" frame of mind soon develops with regard to these. Every estimator knows that a large proportion of inquiries are handed to travellers to shut them up and get rid of them, and his discerning eye easily picks these out. They are usually put on the file to be dealt with (much) later. The discerning eye, needless to say, is always quite wrong, and, on the well-known "cussedness of things" principle, the inquiries put on one side always include the one that contains the germ of an order. The only remedy is to plod steadily through every inquiry and give each its due share of attention on its merits, if any, and a bit more if none.

The chief cause of premature baldness, shown in the Industrial Diseases Reports to be devastating the ranks of the estimators, is the inquiry which doesn't know what it wants combined with an insufficient description of the same. However, the obvious course with such an inquiry is to write the customer, and the traveller for luck, asking for further particulars, "when our estimate will follow in due course"—and wait for a reply. If it never comes, the business is necessarily dead. It usually is, to the writer of this sort of letter, anyway. Nothing annoys a potential customer so much as being told that he doesn't understand his business, especially when he doesn't, and this is what the above letter implies. In addition, it is probable that the customer is waiting to pass his price on to someone else, and the delay while he writes you and you reply may ruin *his* chance. It is far better to quote sufficient alternatives to cover everything his inquiry can possibly mean, or if that should be impossible give him at least two, at the same time hinting that owing to your own extreme mental density you are not quite sure whether you have guessed right, and how pleased you would be to hear whether you are hot or cold, and guess again.

A third point, and we shall have finished with the three outstanding troubles of the estimator, the last being delay. If a customer inquires for something of which you have not the price at hand, you must go to the manufacturer for it, and this will entail a day or two's delay, which, of course, you can't help. Meanwhile the inquiry gathers dust in the abeyance basket. Very few people seem to trouble about acknowledging an inquiry if they can't quote right away, and by the time the information is ready the customer has usually gone in on somebody else's figures. It is a very simple matter to persuade the buyer that he is the darling of your flock, and he will probably hold up his order if you hint *by return* that you are just going into costs with a view

to further reductions, and will let him have something extra special in a post or two.

Now for the traveller. It is his business to get orders in the first place, but he is very thankful nowadays for an inquiry. But why on earth doesn't he ever seem to be able to get full particulars of what they want from his customers? Every traveller for an electrical firm must know that if he sends an inquiry in for a 10-h.p. a.c. induction motor for a 50-cycle supply one cannot offer a machine running at 2,000 revs. as so reasonably required by the customer; and if someone else wants a single-phase motor with a star-delta starter "because they seem to be cheapest" the traveller will send it in marked "Extremely urgent—business prospects very good," and leave it to the estimator to point out to the customer what an ass he is and why he can't have what he wants. It would, of course, be a lot easier and save much time for the traveller to point out what is wrong when he takes his note, at the same time finding out what really is wanted. Neither the traveller nor the estimator dare worry a customer too much over details, but the average traveller's fear of offending a customer being equal to his entire lack of the same quality with regard to the rest of creation, the result is that the office is overdosed with vague and absurd inquiries.

A second point for travellers and, in combination with the above, the chief cause of the antagonism referred to between inside and outside staff, is the inquiry given him "to get rid of him." The aforementioned average traveller usually imagines that the more he talks and the longer he stays in the customer's office, the better chance there is of getting business. Perhaps he is right. The polite customer with no orders to give therefore hands him out an inquiry for something that he has no intention of buying, landing the inside man with the most dangerous form of the disease "work"—useless work. The only man who can really tell whether the injury is genuine or not is the traveller, and it is up to him to suppress it when it isn't. He never does.

One last hint for travellers and I have done. It is a very good thing to follow up quotations to one's customers by a personal call, and very few travellers neglect this part of their job. But who hasn't been worried to death by the pushful fiend who dances in and out of your office half-a-dozen times a day, starting from one hour after his firm's quotation arrives, to know whether that order is likely to come his way? No buyer is likely to be prejudiced in such a man's favour by having his time wasted in that way, particularly when he has to requote. The follow-up business can easily be overdone, and I know at least one busy man who avoids certain manufacturers of his class of goods because he knows that the smallest inquiry will bring a plague of travellers on him: a most ghastly affliction, and if Pharaoh had had it first Egypt would never have needed the other nine.

FUSES.

By A Central Station Engineer.

A short time ago, when talking to a friend who is an authority on switchboards, I happened to mention the word "fuses" in connection with high-pressure a.c. work. "Fuses!" said he, coldly, "I thought that people had given up fuses for 6,000 volts." It was an embarrassing moment, and I am afraid that my reputation for technical knowledge suffered considerably.

Yet fuses are used for high-pressure circuits, and apparently with much success. Their design has gone through a process of trial and error, during which, in this country at any rate, they have got a bad name. The early high-pressure fuse was about a yard long, and it was fixed horizontally. Some of them were used to protect certain cables which ran alongside of a canal.

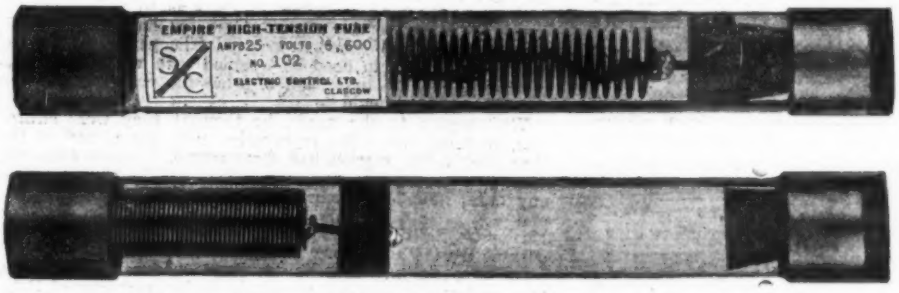


Fig. 1.—"Empire" High-pressure Fuse—Before and After Blowing.

One night, a bargee drove a spike into the ground in order to moor his barge to it, and he hit the cable. The station fuse arced over, and that pattern was soon abandoned. Next the "sparklet" fuse had a run. This fuse, which was very short, was connected between two little bombs filled with liquid CO_2. When the fuse went, it blew a hole into the bomb, and let out a gust of CO_2, which was supposed to blow out the arc. Apparently it did not always do this. A 6,000-volt arc, with thousands of kilowatts behind it, is not always amenable to reason! Then there was the Ferranti oil fuse. This was arranged to blow above the oil, and to pull down into the oil after blowing. The Bristol switchboard was fitted with these, but one day something happened and the whole board blew up. This threw a cloud over oil fuses, and automatic switchgear took their place.

But auto switchgear has its troubles. A switch may be designed to open at 100 or 200 amperes, but if a bad short happens to take place before it can open, the switch may find itself dealing with a current of thousands of amperes. Cases have been known, in these circumstances, where switches have blown up, and have left little behind to tell the tale. The super-station indeed has brought its own troubles, among which is the terrific effect of short circuits. The heavy cost of switchgear is another, as many people are finding out to their sorrow. Electricity lives on finance, and it does not matter how perfect the technical part is if the scheme does not pay.

These considerations have driven designers back to the fuse. The June number of the *General Electric Review* (U.S.A.) described an oil-immersed fuse for 15,000 volts. The fuse has a breaking capacity of 25 times normal current for the heavy duty type, which is considerable. The fuse is very short, and is immersed in oil all its length, unlike the Ferranti type which is drawn under oil after it blows.

An interesting type of fuse (fig. 1) has been placed on the market by Messrs. Electric Control, Ltd., of Glasgow. This is contained in a strong glass tube filled with non-inflammable liquid. The fuse itself is very short, and it is protected from contact with the liquid by passing through a cork. When the fuse blows, a spring is released, which instantly contracts, thus introducing a large gap into the circuit. Simultaneously the liquid is forced into the gap, thus extinguishing the arc. The

short fuse is cooled by the connections, and can thus be run at a high density, which makes it more certain of blowing at the rated current than it would be if run at a low density. The drop of pressure is also much less than for a long fuse, so that the loss of energy is small. Owing to the use of the highly insulating non-inflammable liquid, the fuse can be used for high pressures, up to 110,000 volts if necessary.

The makers give some interesting and useful information in their catalogue. The illustration, fig. 2, shows a fuse blowing on 60,000 volts, with very little splash. At high voltages, there are extraordinary rushes of current during short circuit. In the test on a one-ampere fuse the instantaneous current reached the astonishing peak of over 1,000 amps. At first it might be thought that this would rule the fuse out of action altogether, and that an automatic switch would be

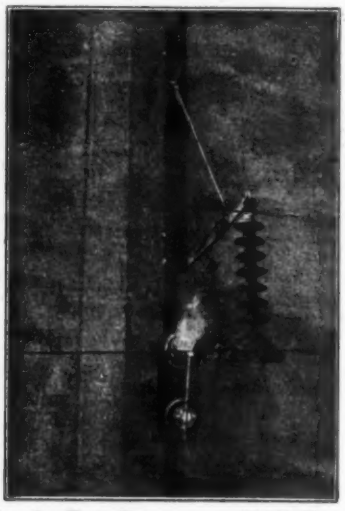


Fig. 2.—Fuse Blowing on 60,000 Volts.

better, but the makers state that the longest time taken to clear the circuit in tests made on the fuses is less than 0.03 second, which is at least five times quicker than the quickest operating oil switch, which usually takes 4 cycles on a 25-cycle circuit, or a minimum of .16 second. Searching tests show that no severe voltage disturbances are produced, so that the rapid opening of the circuit cannot be considered dangerous. This is because S. & C. fuses open the circuit at the zero point of the current wave.

Fuses of this kind are not intended to blow on plain overload. One sometimes sees insurance company inspectors consulting their fuse tables to put in a fuse wire which will blow at a small percentage over the rated full load of the apparatus. This is a mistake. Fuses should never be used for this purpose. They are only suitable for opening the circuit when the overload is very severe, say, at over twice full load. The makers of the "Empire" fuses recommend that their fuses should be used on this basis. They will then efficiently protect the apparatus against anything like a short-circuit current. This will save the switch, which need not be made of an excessive size, even when supplied from a super-station. Incidentally, it might be a good thing to replace oil in transformers and in oil switches by a non-inflammable liquid, somewhat similar to that described by the Electric Control Co. This liquid has a dielectric strength of 250,000 volts per inch, and is one of the most effective fire-extinguishing liquids known. The use of such a liquid should be a great help in enabling switches to break heavy rushes of current without danger.

If the "Empire" fuses fulfil their promise, they will be a valuable aid to the protection of apparatus, and they will also help to cheapen supply, a most important item. It seems even possible that such an improved fuse would enable us to do without pilot wires and much of the elaborate and expensive protection now required on high-power systems, and that would be a gain.

LEGAL.

Weston Electric Lamp Co. v. Dunn.

In the Shoreditch County Court on Friday, before Judge Cluer, the plaintiffs sued Mr. Dunn, of Ramsgate, dealer in electrical goods, to recover £3 1s. for goods supplied. Mr. Cripwell appeared for the plaintiffs, and Mr. A. R. Rule for the defence. Mr. Cripwell said the goods were sold on March 21st and sent on March 23rd, with an invoice the same night. Later they heard that on April 1st defendant had paid the traveller, a man named Stewart. The invoice clearly stated that travellers were not to be paid, but by an oversight he had omitted to give the defendant notice to produce it, so he could not produce a copy. Mr. Howard Fencron, of the plaintiff firm, said it was an invariable rule to send out an invoice on the day the goods were dispatched. They could trace no line from their agent to say he had been paid. Witness admitted on being shown a receipt that it was signed by the traveller Stewart. Judge Cluer: Stewart is your traveller, and you must prove you told the defendant not to pay him. You have been cheated by this dishonest traveller, and unfortunately you have not prosecuted him. Mr. Cripwell: May I have an adjournment? Judge Cluer: Oh, no; that only means bringing them up from Ramsgate again. There will have to be a verdict for the defendant, with costs.

Mather & Platt, Ltd., v. Low & Co.

In the Commercial Court of the King's Bench Division on November 17th, Mr. Justice Bailhache was occupied with an action brought by plaintiffs, of Manchester and London, against Messrs. H. V. Low & Co., East India merchants, of London Wall, E.C., in which plaintiffs claimed to recover the price of machinery sold to the defendants in connection with the electrification of some jute mills in India. Defendants said they were not liable.

Mr. Neilson, K.C., for plaintiffs, said it appeared that the defendants had some connection with a firm of the same name, a limited company in Calcutta, which again had a connection with jute mills in India. There was a company in India called the Behar Jute Mills Co., formed for the purpose of providing factories for the manufacture of jute, and this firm required machinery. A representative either of Low & Co. or of the Behar Jute Co., a Mr. Skinner, came home from India about the end of 1919 and got into touch with Mather & Platt with a view to discussing an order for machinery to go to the Behar Jute Mills. The matter was discussed at some length, and Mr. Skinner used Messrs. Low's offices in London for the purposes of his negotiations. Eventually a tender was prepared by Mather & Platt and sent on February 16th, 1920, to Low and Co. On February 23rd a letter was written upon which a great deal would turn, in which it was stated "We have much pleasure in accepting your tender." It was signed "W. Skinner" in his individual capacity and "H. V. Low and Co." below it. Upon the faith of that Mather & Platt proceeded to manufacture these goods and get them ready for shipment. Most of the goods were made in time, and some were, in fact, supplied but had not been paid for. The defendants said they were merely agents to hand such money as they got from the Behar Jute Mills Co to the plaintiffs, and that they had incurred no personal liability themselves. That was towards the end of 1920, and at the beginning of 1921 the Behar Jute Mills Co. went into voluntary liquidation. The question was therefore whether Low & Co. had entered into such a contract with Mather & Platt as to bind them and make them answerable for damages for having repudiated their contract and refusing to pay. The parties had agreed that all his Lordship need be troubled with was the question of liability and an indication of what the proper measure of damages, if any, would be.

With regard to the goods, he thought they were entirely manufactured when the repudiation took place, and at that time the Indian market had disappeared. These were very special goods, and he understood they could not be used for any other industry. Some parts of them could be separated and the parts taken into stock by the engineers, and that Mather & Platt were prepared to do; but the others could only be treated as scrap.

Mr. Mackinnon, K.C., for the defendants, said Mr. Skinner was, and was known by everybody to be, manager of Behar Jute Mills Co., Ltd. Counsel submitted it would not be right to hold that the purchasers of this machinery were Messrs. Low. The right conclusion was that the purchasers were the Jute Mills Co., and that the document signed by Messrs. Low was signed only in their capacity as agents for those principals.

His Lordship, giving judgment, said he had come to the conclusion in the circumstances of the case that H. V. Low and Co., signing this document, must be taken—particularly having regard to the fact that it was signed also by Mr. Skinner—to have held themselves out as the actual contracting parties or the parties who were in fact guaranteeing the performance of that contract. He sympathised with Messrs. Low, but there must be judgment against them. Plaintiffs would have judgment for £5,227 for the goods actually supplied. With regard to the rest, the plaintiffs must give credit for the amount they were able to take into stock, while as to that which could only be scrapped, credit must be given for

its value as such. The question of damages must be referred to a referee, and while Mather & Platt must be reasonably compensated, he hoped they would not press their claim for damages to an extreme.

Attorney-General v. Liverpool Corporation.

Mr. Justice Russell, in the Chancery Division on November 17th, delivered his considered judgment in this action, already reported in the Electrical Review.

His Lordship said it was alleged by the plaintiffs that the Corporation were carrying on their business in electrical fittings in houses and buildings within and without the city, and also in houses and buildings to which they were not supplying electrical energy. The Corporation admitted supplying within the city, but denied the other allegations. Evidence in support of the allegation as to work outside the city broke down, and no evidence was offered on the third allegation. The question he had to decide was whether in the circumstances the Corporation were entitled, at the risk and expense of the ratepayers, to carry on the business complained of. Before the year 1896 the Liverpool Electric Supply Co., Ltd., carried on an extensive electrical fittings business, but in that year the Liverpool Electric Supply Transfer Act was passed, under which it was provided that the Corporation should purchase the whole of the company's undertaking, including all their property and assets, real and personal, together with all their rights, powers, and privileges. In 1901 the Corporation came to an agreement with the Garston Electric Supply Co., Ltd., whereby they purchased that company's undertaking and all their rights, powers, and privileges. His Lordship said he would deal next with the validity of the complaints made by the plaintiffs. The Corporation had carried on the business for many years now, and one thing was clear, viz., that in the absence of special powers they would not be entitled to do so merely because they were authorised to supply electrical energy. Their powers ceased with the supply of energy to the terminals. The Corporation raised two defences. The first was that they had the statutory authority to carry on the business by virtue of the Liverpool and Garston Transfer Acts, and the second was that they were a common law corporation, and as such they had all the powers and rights of individuals, subject only to the limitations imposed by the Municipal Corporations Act, and that they had never transgressed those limitations in the carrying on of this business. On the first, if the Corporation were right, no question of any alleged mis-application of funds could arise. Dealing with the different sections of the 1896 Act, he said the plaintiffs alleged that even if the undertaking of the Liverpool Co. was transferred to the Corporation, it was not the intention of the Act that the business complained of should be carried on by them. Apparently the Corporation were to spend money in acquiring something which they could not turn to account, either by selling it to somebody else or by working it for their own benefit. After considering the sections of the Act, his Lordship said he had no doubt as to their intention and operation. The Act was framed on the footing, and it provided in terms, that the Corporation were to step into the shoes of the company and to have the power to carry on the whole undertaking and the businesses of the company. In the result he decided in favour of the Corporation on the first ground of the defence. The second ground of defence therefore did not arise, but since the case might possibly come before a higher tribunal, he would deal with it. The evidence of the plaintiffs on the point that the defendants were a common law Corporation was directed to show that the business was carried on at a loss, and that the Corporation had resorted to their funds in transgression of the limitations of the Municipal Corporations Act. But he found that the business had, in fact, been carried on at a profit from 1911 to 1920, except in 1913, and that the Corporation had not contravened the Act. The Corporation were vested by the Transfer Acts with the power to sell and deal in electrical fittings, and the action therefore failed, and must be dismissed with costs.

Mr. Alfred Page, K.C., for the plaintiffs, intimated that there might possibly be an appeal.

Electrical Company Prosecuted in Australia.

According to Sydney reports dated September 20th and 21st just to hand, the Edison Swan Electric Co., Ltd., of Sydney, was summoned for alleged breaches of the Customs Act. There were six informations, which set out that in 1917 and 1918 the company, by its agent, George Wall, made, in a declaration produced to a Customs officer, untrue statements respecting the fair market value of certain goods imported into the Commonwealth, with intent to defraud.

The magistrate (Mr. Adrian) convicted in each of the six cases of making and producing the declarations in question, but not with intent to defraud the revenue. Fines aggregating £400, with £19 7s. in costs, were imposed.

In the course of the hearing it was stated on behalf of the company that no evidence would be tendered for the defence. Mr. Davis, appearing for the company, said that the invoices were prepared in London and sent to Sydney. The only way the company had of explaining the matter was to get a commission from London. He had nothing at hand and could only obtain it after a long and expensive investigation. The man responsible for the passing of entries had passed away himself. The Crown had decided to charge the company in a serious way—that untrue statements had been made with intent to defraud—and it was for them to prove the allegations, but they had not done so on the evidence. Nothing had been done to show that any one invoice was false or untrue. There had been no deliberate attempt by the company to defraud the Customs Department. Only a small amount was involved. The company, he contended, could not, under the Act, be charged with "making" and "producing." It must be one or the other.

British Thomson-Houston Co., Ltd., v. Corona Lamp Works, Ltd.

On Tuesday, November 22nd, at the House of Lords, the arguments were concluded in the appeal by the British Thomson-Houston Co. in their attempt to establish the validity of their letters patent No. 10,918 of the year 1913, for "Improvements in incandescent electric lamps."

Last week, Sir Duncan Kerly, K.C., opened the case for the respondents, the Corona Lamp Works, Ltd., and said that the action was brought by the appellants for the purpose of obtaining an injunction against his clients, and after a protracted hearing Mr. Justice Sargant pronounced an oral judgment, holding that the letters patent were invalid on the ground that the appellants had failed sufficiently to define or limit the ambit of their claim. That judgment was upheld by the Court of Appeal. The appellants' alleged invention related to incandescent electric lamps, in which the filament incandesces in an atmosphere of gas or vapour instead of in a vacuum. This type of lamp was well known in 1913, and all the appellants could claim for their alleged invention was a statement in the specification that an advantage could be obtained if the filament was made of "large" diameter. The appellants' alleged invention was not subject matter of a valid patent, but was at most a discovery to the effect that a gas-filled incandescent lamp with a filament primarily thicker was more efficient than one with a primarily or secondarily thinner filament and was not a patentable invention.

On Monday this week Sir Arthur Colefax replied, and he took until midday on the following day.

Lord Haldane said their Lordships would take time.

Telephone Companies' Articles.

In the Chancery Division on November 15th, Mr. Justice Astbury confirmed the alteration of the memorandum and articles of association of each of ten companies subsidiary to the Telephone Manufacturing Co. of 1912, so as to enable the respective companies to raise working capital which hitherto had been obtained by the parent company from its bankers, the latter company providing an issue of £300,000 debentures secured on the share capital of the subsidiary companies.

Mr. Luxmoore, K.C., for the petitioning subsidiary companies, stated that the Manufacturing Co. owned or held by its nominees all the shares in the subsidiary companies. The parent company manufactured telephones, instruments, and apparatus for its system, which was specially designed for large buildings. The subsidiary companies bought these and let them to users on contract at a fixed rent, the companies fixing and maintaining the apparatus. There were 13 subsidiary companies. The 10 companies before the Court were the Sheffield, South Wales and Monmouthshire, Liverpool, Birmingham, Leeds, Bristol and West of England and Newcastle Telephone (New System) Companies, Ltd., Lancashire and Yorkshire Private Telephone Co., Ltd., I.T.C., Ltd., and New System Private Telephone Co., Ltd.

Electric Locomotives.—The Blackburn Corporation has in commission an electric locomotive supplied by the English Electric Co., on the railway siding that runs alongside the new electricity works at Whitebirk. It has a haulage capacity of 80 tons, and has at times drawn as many as eight 10-ton railway trucks. It rendered excellent service during the constructon of the new electricity works in conveying the new plant, &c., from the railway sidings to the site. It has been stated by the Borough Electrical Engineer (Mr. P. P. Wheelwright) that considerable economies have undoubtedly been effected by its use.

Precise running costs are not available, but these, we understand, are being ascertained. The locomotive is staffed by two men. Chloride batteries are employed.

There is probably scope for electric locomotives on the dock estates of the various ports, at some of which, where there is rail transport between the quay-sides and the adjoining goods stations, there is a considerable amount of short rail haulage and shunting.

At Liverpool, for instance, where there is a "slow" goods line running the whole length of the docks and sidings alongside many of the dock transit sheds, electric locomotives might usefully be employed, but the trouble that is experienced at the Liverpool docks with regard to the employment of electric vehicles, is the inadequacy of the charging facilities.

ELECTRICAL PROGRESS IN LATIN AMERICA.

Revival of Activity in Hydraulic Installations.

(By Our Own Correspondent.)

The first electric locomotive manufactured for Brazil has arrived in that Republic. The engine was made to the order of the Compañhia Paulista de Estrada de Ferro (Sao Paulo, Brazil), and has been built by the Baldwin-Westinghouse Co., U.S.A. A number of other passenger-locomotives of the same type are being rapidly constructed and will be delivered some time this year, and the balance towards the commencement of 1922. In the meantime, the electrification of the lines is making sensible progress. The Compañhia Paulista de Estrada de Ferro is one of the most important company-owned lines in Brazil, and has distinguished itself by being among the first of the railway companies to take advantage of the large natural water supply of the country.

The Municipality of Sololá, in the Republic of Guatemala, is desirous of installing an electric light plant, for which purpose a loan of $15,000 gold (£3,000) has been raised.

A neighbouring Municipality, that of Nuévo Progréso, is about to expend a smaller sum—$3,750 (£750)—for the same purpose, taking power from the same river.

In addition to the existing electric light and power plants of Mexico City, the original concession for which expires next year, and, which it is understood, will not be renewed upon the same terms as previously, the original company has, in the meantime, been given permission to construct two additional plants below the dams of Necaxa, on the river of that name. It is estimated that twelve to eighteen months will be required for the purpose of constructing the first plant, and three years for the second. When both are in operation, they will be in a position to supply 30,000 horse-power, which will be in addition to the 60,000 h.p. which the company controls at present.

The Ferrocarril Oesta of Buenos Aires has received authorisation from the Ministry of Public Works to extend the electrification of its lines to the town of Moréno.

In accordance with the Presidential decree issued from the palace at Havana, Cuba, a factory for the making of electric light bulbs is about to be installed in the capital of the Republic.

The Municipal Council of Ibarrá (Ecuador), has decided upon the installation of an electric plant for public and private lighting service in that city, the power to be derived from neighbouring water-falls.

A three-year concession has been granted by the Municipality of Autofagasta (Chile) for placing electric signs upon some of the principal buildings in the city. The concessionaire will pay the municipality 20 pesos monthly for each sign erected, and the proceeds will be used for school-prizes.

A contract for the lighting of Port au Prince and Cape Haitien, in the Republic of Haiti, has been awarded to a new Haitian company capitalised at $250,000 (nominally £50,000).

A hydro-electric station is about to be constructed on the river Pirisicaba, in the State of Minas Geraes, Brazil, in order to operate the large iron mines of Itabira de Matto Dentro. A portion of the railroad already in existence will, at the same time, be electrified.

Progress is being made upon the construction of the largest electrified sugar-mill yet erected in Central America, namely that of La Lima, in Honduras. Power is being developed by a 1,000 kW turbo-generator set, with an auxiliary 200 kW set for lighting and general purposes. The electric installation is 440 volts, 60 cycles, and has a Curtis steam turbine prime mover running at 3,600 r.p.m.

The town of El Refugio, in the Republic of El Salvador, has signed a contract for the construction of an installation of electric lights which will be under the management of the newly-formed electric light company of the city of Chachuapa.

In Havana (Republic of Cuba), a modern service works for the prompt repair of all kinds of electrical machinery has been established.

In Ecuador, a special trial illumination has been installed on the Calle Pichincha, between the two streets, Aguirre and Francisco de P. Icaza. The system consists of 100 and 150 c.p. globes with special shades which project the light into the street. New Diesel engines have been installed in the power station, and these render it possible to furnish all the light needed at a lower cost than that of the former system of street lighting.

The Mexican Department of Industry and Commerce has granted a concession to the Compañia de Luz y Fuerza Eléctrica to construct an 80,000-h.p. electric plant in the State of Michoacán. A similar plant is about to be erected in the city of Puebla, utilising a waterfall which will furnish a minimum of 70,000 h.p.

The important port of Tampico (Mexico), which has hitherto put up with mule-drawn tramways has received a concession for the introduction of a complete electric street-car service running from the Plaza de la Union through the principal points of the colonies of Volatin, Azteca, Rosario, Américana, Tolteca and Rodriguez, joining the Aguila line near the new cemetery.

The Peruvian Government is offering every encouragement to those wishing to exploit the hydraulic potentialities of the country, which are said to be exceptionally promising. The available water area is from 50 to 150 kilometres from the scene of population, but close to the mining districts on the Andean table-land. It is proposed to construct a canal from a stream which will render available many thousands of horse-power. An estimate of the hydraulic potentiality of Peru is 15 million h.p., whereas the total capacity of the present electric plants scarcely exceeds 52,000 kW. Of this, over 41,000 kW is derived from waterfalls.

The Municipalities of Santiago and Puerto Plata, in the Republic of Santo Domingo, have recently purchased from the Compañia Anônima Dominicana de Agua, Luz y Fuerza Motriz, the whole of their plant and machinery which supply both cities with water, light and electric power. It is proposed thoroughly to overhaul and reconstruct the works, and to introduce some of the latest and most economical class of machinery.

A complete installation of electric cranes and other loading plant will be required in connection with the new port works at Buenos Aires, where 1,000 men are now employed upon the construction. Orders have been received for the work to proceed day and night in order that the new port may be ready at the earliest possible moment.

The Guatemalan Government is considering the construction of an electric line from the city of Guatemala, the capital of the Republic, to the former capital Antigua. Tenders will shortly be invited from foreign contractors, who will be expected to accept part of their payment in government bonds, duly secured.

The electric lighting companies at Guaymas and Hermosillo, in Mexico, have recently obtained large quantities of poles from the State of Oregon, U.S.A. Cedar poles are mostly in use.

ELECTRICITY DISTRICT INQUIRY.

South-West Midlands Electricity District.

The local inquiry by the Electricity Commission with regard to the area to be included in the South West Midlands Electricity District took place at the Council House, Birmingham, on Tuesday, Wednesday, and Thursday last week, before Sir Harry Haward (vice-chairman of the Commission), Mr. H. Booth, and Mr. A. Page. The object was to hear objections and representations made on account of the inclusion in, or exclusion from, the district of certain areas, and to consider (*a*) a scheme which had been submitted jointly by the Birmingham Corporation and the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for effecting an improvement of the existing organisation for the supply of electricity in the district, and for the formation of a joint advisory committee; and (*b*) a scheme submitted by the Worcester Corporation for effecting a similar improvement in certain parts of Worcestershire, including the city of Worcester. The area of the district, as provisionally delimited by the Commissioners, comprises Shropshire, Worcestershire, and parts of Staffordshire and Warwickshire.

The case for the Birmingham Corporation and the Shropshire, Worcestershire and Staffordshire Co. was presented by Mr. W. B. Clode, K.C. (with whom was Mr. H. H. Joy), who, having described the geographical aspects of the Midland area, said its electrical condition was exactly what might be expected, having regard to the somewhat parochial view Parliament had taken about electricity in the past. Some districts were absolutely unprovided with a supply, not being in a position to afford one, while other districts, which had embarked upon creating a supply for themselves, were now in possession of generating stations which were less efficient than they ought to be. Birmingham had risen to its opportunities, and was trying to meet the various needs of its constituents. There were small and large stations—the smaller becoming in course of time inefficient—and the city was looking forward to creating large power stations and a super-station at Hams, near Coleshill. Counsel referred to the area supplied by the Leicestershire and Warwickshire Power Co., and stated that they had divided the entire district into two parts, and, by agreement with that company, suggested that the Leicestershire the Warwickshire Company should continue to supply the area over which it possessed powers, except that consumers in the portion nearest Birmingham should look to the Corporation for its supply in the first instance. If either party were unable or unwilling to supply in its respective area, then the other party should have the right to come in. Provision for Birmingham to supply the area over which the Leicestershire company now possessed powers was made in the draft scheme. With regard to the other side of the district, Mr. Clode said the Rowley Regis, Lye, and Stourbridge areas apparently did not want to be included in the South-West Midlands District, and he suggested that those areas should go out; Birmingham was unable to supply them. The Shropshire Co. had now power to supply in that area, subject to the consent of the Midland Electric Corporation for Power Distribution.

Mr. Tyldesley Jones, K.C. (with whom was Mr. Norman Birkett), for the Midland Power Distribution Corporation, informed the Commissioners that a provisional agreement had been signed by the companies concerned, whereby the area should be transferred to the North-West Midlands District, in which the Shropshire Co. had certain rights, on the understanding that the position of that company in the North-West District was in no way prejudiced. He asked the Commissioners at once to give a decision on the point, in order, on the ground of expense, that he and his witnesses might withdraw from the inquiry.

Evidence was given by Mr. L. J. Cook, of the Stourbridge Borough Council, to the effect that that town desired to be retained in the South-West District.

Mr. Clode stated that in January, Stourbridge Council objected to being included in the South-West District.

Mr. Jones urged that the consumers of Stourbridge did not want to be included in that district. It seemed that Stourbridge was trying to play one company against the other for a financial consideration.

The Commissioners decided to exclude from the South-West District the municipal borough of Stourbridge and the urban districts of Rowley Regis, and Lye and Wollescote.

Mr. Clode, dealing with plans for development, pointed out that a question for consideration was whether the existing arrangements and organisation for the supply could be improved. They had provisionally determined that they should be improved. The Shropshire Co. and the Birmingham Corporation, desirous of giving the district a better supply, proposed to act in unison, and to set up an advisory committee. They believed that what would be done in a roundabout and more expensive way by the setting up of a joint electricity authority, could be done better and cheaper by those two large bodies (which were now generating 38 per cent. of the electricity in the district) acting together and in agreement. Counsel submitted that no advantage could be derived by calling into existence a joint electricity authority. Birmingham was willing that Sutton Coldfield, as the only other authority generating, should go on if it so desired, though ultimately he supposed it would see the wisdom of shutting down its station and getting its supply from Birmingham. Similarly, Kidderminster and Halesowen had already seen the advisability of looking to the Shropshire Co. for the supply of their needs. By this joint arrangement it was estimated that a considerable reduction in price would be possible: the estimate was that the price of delivery to authorised distributors in 1925 would be 0.953 of a penny per unit, and in 1930 it would be 0.866 of a penny.

After questions to Mr. Clode, Sir Harry Haward said he gathered the promoters of the scheme had not considered placing themselves under any sort of obligation to carry out the technical scheme.

Mr. Clode: They don't think it ought to be asked of them in the circumstances in which they promote the scheme.

Mr. Tyler, on behalf of the L. & N.W. and G. W. Railway Companies, spoke of the attitude of the railway companies. They were not anxious to incur unnecessarily the capital expenditure of building generating stations for themselves. They would prefer to purchase rather than to generate, not abdicating, of course, any of their rights under the Electricity Act of 1919. The companies could not state definitely that they would need a demand for traction purposes before 1931, but it would be a mistake to allow the Commissioners to assume that there could not possibly be a demand before that year. He objected to a statement that if the railways were electrified it was estimated that approximately 60,000 kilowatts would be required to supply a system within a radius of 50 miles from Birmingham. There were 2,000 route miles within that radius, so that such an estimate was much understated. He promised, in reply to the Chairman, to give the best estimate that was possible now. The companies were reasonably satisfied that the scheme, so far as it was developed, would offer a reasonable prospect of their getting such a supply as they might require.—Mr. H. K. Beale, Chairman of the Birmingham Electricity Supply Committee, said the view of the Birmingham Corporation was that a joint electricity authority would not be able to do any better than the Shropshire Co. and Birmingham acting together.—The Commissioners expressed the opinion that there ought to be something in the nature of an obligation placed upon the two undertakings to carry out the programme foreshadowed.

At the opening of the inquiry on Wednesday Mr. Clode stated that his clients had tried to meet the suggestion, and proposed to insert in their scheme a clause "that it should be the duty of the Corporation and the company to provide or secure the provision of a cheap and abundant supply of electricity in the district, and that both parties should comply with any general directions given to both, or either of them, by the Electricity Commissioners through the medium of the Advisory Committee." Counsel said the clause was similar to one inserted in all joint electricity authority schemes under the Act of 1919, and he also suggested the insertion of a clause to obviate the possibility of an *impasse* arising by a two-and-two division on the Advisory Committee, which was composed of two representatives of the Corporation and two of the company. The clause provided that in the event of a majority decision not being arrived at by the committee on any particular matter the respective representatives of the Corporation or the company should report the same to the Corporation or the company, as the case might be, and in the event of a decision still not being arrived at, either party should be at liberty to submit such difference of opinion to the Commissioners for their directions.

The Chairman asked if the parties would be prepared to carry out the specific directions of the Commissioners, and Mr. Clode replied that he could hardly conceive any difficulty arising on that point.

The Chairman said the Commissioners were prepared to accept the first clause, with the addition of the words "or special" in relation to the directions which the parties undertook to comply with.

Mr. Clode undertook to endeavour to meet the Commissioners.—The Commissioners also accepted the other clause with minor alterations.

Mr. Emile Garcke, Deputy Chairman of the Shropshire Co., said the joint scheme would be more suitable for the district than a joint electricity authority, and would be able to make better progress.

Mr. Kennedy, for the Malvern Urban District Council, announced the withdrawal of Malvern's opposition as the propounders of the scheme had agreed to the insertion of a clause that it should not affect their rights.

The Chairman told Mr. Garcke that the Commissioners would need to be satisfied that the two promoters of the scheme were in a position in a reasonable way to meet the demands that were likely to come upon them.—Mr. Garcke replied that the financial position of the company was quite strong and satisfactory, and capital recently raised would provide for the present commitments, and for the next year or two.

The scheme of the Worcester Corporation was submitted by the Hon. Reginald Coventry, K.C. He said an agreement of mutual benefit to the Corporation and consumers had been made with the Shropshire Co., whereby, subject to the approval of the Commissioners, the city retained its power station. The agreement also gave it facilities and rights to supply an area outside the city boundary, which included some of the chief villages in the neighbourhood. The Shropshire Co. raised no opposition to a proposal to lay a transmission cable from the generating station to the borders of Herefordshire. Reciprocally, the Worcester Corporation offered no objection to the Shropshire Co.'s laying a transmission cable through its streets. Within a reasonable time the Corporation would be in a position to supply the whole of the extended area.

Evidence as to the financial aspect of the joint scheme was given by Mr. Arthur Collins, late Birmingham City Treasurer. It was pointed out that the scheme contemplated that Birmingham would have to raise during the next ten years over two million pounds as its share of the total cost, and witness said there ought to be no difficulty whatever from the capital point of view.—Mr. R. A. Chattock (Corporation Electrical Engineer, Birmingham), stated that with the proposed Stourport power station in operation there would be no difficulty in the promoters meeting all demands. In the absence of that station, however, the Hams station would have to be running in about eight years' time. He agreed that if the Stourport station was not proceeded with a readjustment of the whole scheme would be necessary. Under the scheme the saving in coal in 1925 as compared with the present time would amount to 118,200 tons per year.

It was stated by Mr. J. T. H. Legge, engineer to the Shropshire Co., that they had a scheme for dealing with several of the more prominent towns, like Bromsgrove and Droitwich. Rural areas could not be economically served unless the question of wayleaves was very much eased. He had been asked to pay as much as £15 per pole for carrying an overhead line over certain land near Stourport. They hoped for assistance in this matter from the Commissioners. Overhead lines were essential in rural areas, and, so far, more opposition than help in erecting such lines had been experienced. Regarding the business of the company, ten million units were sold in 1913, and 64.33 million in 1918, but there had since been a falling off. The average price per unit was 1.62d. For lighting towns they charged 6d. per unit. There was no reason for asserting that they did not intend to proceed with the Stourport station; they looked forward to doing so as the demand came along—probably to make a start at the end of next year. Stourport had unlimited advantages as a site, because of its natural characteristics, and also because new coal fields were being opened in the area. With a joint scheme neither undertaking need carry the reserve plant necessary in working individually, and working costs would be lessened. His company would take supplies from Worcester Corporation for the next two or three years until the Stourport station was running, so as to meet the rural demand.

Mr. C. P. Sparks (consulting engineer), expressed the view that the middle of next year would be the best period to purchase plant for the Stourport station, as prices were falling.

The promoters intimated that they had no objection to the inclusion of Kinver and Dudley rural district in the area.—The Chairman announced that the Martley Urban District Council desired to be excluded; that Upton-on-Severn wished to be included, but desired to take its supply from Worcester; and that the Tamworth Borough and Tamworth Rural District Councils desired the whole of their areas to be included.

It was urged by Mr. Reay-Nadin that Sutton Coldfield should be entitled to have representatives attending the

Advisory Committee when matters affecting it were under consideration.

Mr. Capel Loft (Stourport) opposed the scheme on the ground that voluntary co-operation between the parties would be equally effective. In reply to Mr. Beardmore (Electrical Workers), the Chairman said the question of the insertion of a fair wages clause in the agreement did not arise at the inquiry.

Mr. Clode said he desired to make it perfectly clear that the promoters were most desirous of developing the district and doing their duty. They did not want to keep out anybody who wanted to come in. He pointed out that nearly all the objections to the scheme had disappeared.

The inquiry then concluded. The Commissioners will give their decision in due course.

THE PUBLIC WORKS, ROADS, AND TRANSPORT EXHIBITION.

On November 18th, Mr. Arthur Neal, M.P., Parliamentary Secretary, Ministry of Transport, opened the above exhibition at the Agricultural Hall. The exhibition was primarily intended to present to representatives of municipal authorities the latest developments in machinery and methods for accomplishing the many and varied works now carried out by these authorities. Naturally building construction and road making and maintenance formed the principal part of the display, but lesser subjects, such as small holdings, office furniture, time recorders, &c., were also given space. Motor-driven machinery was not so much in evidence here as at most recent exhibitions, but this was, of course, due to the fact that such appliances have a roving commission, and are often (or perhaps generally) required where no electricity supply is available. As was to be expected, electric vehicles played a not unimportant part, and several firms exhibited examples of their work.

Electricars, Ltd., showed a 2½-ton Edison accumulator wagon. In this vehicle the battery is placed in front of and partly underneath the driver's seat, and power is transmitted to two totally enclosed motors fixed at an angle on each side of the chassis. An extended shaft transmits the power to the rear wheels. The body is constructed of sheet steel channel sections on the outside, allowing a clear sweep for the load when tipping. The tipping gear is electrically operated by a small auxiliary motor; the time taken is about 20 seconds. This firm also had a similar chassis fitted with a 700 gal. tank, similar to one supplied to the Islington Borough Council for road watering.

Clayton Wagons, Ltd., displayed a 3-ton wagon of substantial proportions. This was driven by a single B.T.H. motor, fed from a Chloride Co. battery, the drive being transmitted to the rear axle by two chains. The road wheels were mounted on ball bearings.

Messrs. Richard Garrett & Sons, Ltd., had a 2½-ton "electric" fitted with a wood end-tipping body measuring 11 ft. by 7 ft. inside.

British Electric Vehicles, Ltd., in addition to two electric trucks of 1,500 and 5,000 lb. capacity respectively, showed a battery locomotive designed to run on a 1-m. gauge track, and capable of hauling a load of 10 tons on the level. The locomotive is provided with two motors wound for series-parallel control. The controller is of the drum type, arranged to give four speeds in either direction. The battery is capable of providing energy for a run of about 20 miles.

The General Vehicle Co., Ltd., had three vehicles on show. One was a 2-ton chassis fitted with a street-watering tank interchangeable with an end-tipping body. A 3½-ton chassis was shown bearing a "Craymer" unloader. The third exhibit was a 5-ton chassis with a 3-way (side or end-tipping) body. These vehicles were all fitted with "Ironclad-Exide" batteries and series-wound motors capable of a 300 per cent. overload. The ranges of the three vehicles are 45, 35, and 30 miles respectively.

Messrs. W. Goodyear & Sons, Ltd., included in their display a 2-ton "Greenbat" electric truck.

Mr. H. C. Slingsby also showed transporter and lifting trucks.

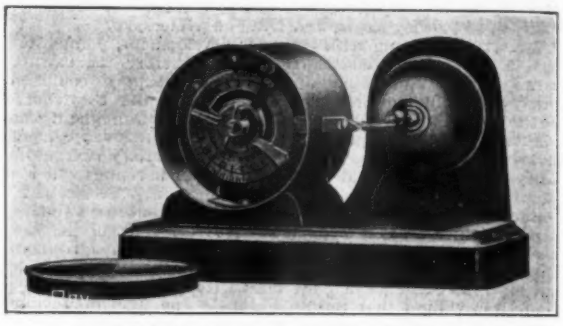
Messrs. Ruston & Hornsby, Ltd., exhibited the 15-cwt. runabout electric crane (Mossay & Ransome system), which was described by us recently in connection with another exhibition (Elec. Rev., Oct. 21st, p. 545).

Stevens Petrol-Electric Vehicles, Ltd., showed a 3-4-ton petrol-electric chassis similar to those supplied to a number of municipalities and Government departments.

On the stand of Messrs. G. Percy Trentham, Messrs. Buckley, Saunders & Co., Ltd., exhibited numerous examples of welded work. These included lap and butt welds of various types, angle welds, &c. Sections through samples and welded pieces subjected to tests showed the efficiency and strength of the work. In an enclosure, screened with tinted glass, demonstrations of rail welding and building-up were given.

The Evinrude Motor Co. (England), Ltd., showed the "Evenlite" small-power lighting set. The engine of this set is a 2 h.p. "Evinrude" petrol engine with a force pump cooling system. Connected to this by a flexible coupling is a 500-watt, four-pole, shunt-wound dynamo, with a full-load speed of 1,000 r.p.m. This machine has a comparatively large commutator and well-designed brush-gear. The engine and dynamo are securely bolted to a massive cast-iron bed-plate. The switchboard is of slate, 18 in. square, and of simple design. It bears a voltmeter, an ammeter, an automatic cut-out, and a d.p. switch and fuses. The battery consists of 13 Fuller's cells with a 100-Ah capacity and a pressure of 25 volts. The plant is supplied with a special adapter, which enables a supply to be taken from a petrol can.

The Horstmann Gear Co., Ltd., displayed numerous examples of time switches. The "Newbridge" time switch has a 14-day clockwork unit with double-roller lever escapement. To this is attached a s.p. quick make-and-break switch with self-adjusting spring plunger contacts in circuit



The "Horstmann" Time Switch.

with a porcelain "" damper" fuse and special contacts on an ebonite base plate connected to the outside wiring. The gear is enclosed in a strong cast-iron case. The "Horstmann" switch consists of a clockwork mechanism and an independent tumbler switch. The latter is actuated by a link moved in or out by tappets fixed to the rotating dial of the clockwork. The two parts of the mechanism are mounted on a teak base.

The Rawlplug Co., Ltd., showed several applications of "Rawlplugs" to various materials. These included instruments mounted on slate switchboards, and fittings on brick, concrete, cement, &c.

The Unchokeable Pump, Ltd., demonstrated one of its appliances driven by a small electric motor. This was a 3 in. pump working under severe conditions, passing heavy solids, such as nuts, stones and tins, and such substances as cotton waste, rags and straw.

Messrs. R. A. Lister & Co., Ltd., showed examples of "Lister-Bruston" power sets. These are automatic sets, consisting of a vertical water-cooled "Lister" engine driving by belt a shunt-wound dynamo. These are mounted on a heavy bed plate and a cylindrical fuel and water tank is mounted between them. The two sets shown were of 1 kW and 6 kW capacity. A special feature of the 6kW set was the separate casting containing the bearing for the engine shaft, which was bolted on to the main casting. A ¾-kW "Lister" lighting set was also shown.

During the exhibition a number of conferences were held by various municipal associations. To-day, which is the last day of the show, the I.M.E.A. is holding a conference, when papers on "Electric Vehicles for Municipal Purposes," and "The Application of Electricity to Municipal Services" are to be read by Messrs. F. Ayton & S. J. Watson respectively. We hope to say more of these papers in a later issue.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal* (Johannesburg), in its issue of October 29th, says: "Dealers in electrical goods were more hopeful this week as to business in the near future. They confirm the improvement which has taken place during the past two or three weeks, and state that trading is now good again, both in town and country. There are no alterations to report in prices, which remain very steady, with, if anything, a tendency to rise. Stocks in all lines are now full, and consignments continue to arrive in fair quantities from Britain, America and the Continent. Those from the latter destination continue still to be much below British quotations, but signs are not wanting that a gradual levelling up is taking place, and it will not surprise dealers if within a few months' time the present discrepancy between the prices of British and Continental electrical materials, with one or two exceptions, disappears to a considerable extent."

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Construction of Rheostats.

We were interested in reading on page 681 of the current issue of the Electrical Review, a note concerning "Rheostats with the minimum of material."

As manufacturers of a large variety of resistances of all kinds, we would like it to be known that we do not consider the method therein described is new, because we have been utilising parallel and series-parallel methods of winding for some years.

We believe that it is an obvious fact, well known to makers of resistances, that an ordinary series resistance is, as a rule, uneconomical, as when the regulating switch is adjusted for high current values, only a small portion of the resistance material is in circuit, so that, instead of all the resistance material being utilised to radiate the heat, there is a comparatively small portion of it running at high temperature.

Many years ago Dr. J. A. Fleming pointed out the advantage of paralleling resistance wires in the manufacture of load resistances, and we are, therefore, surprised that R. Richter should claim this method as being new in his recent publication in the "E. T. Z."

L. F. Fogarty,
The Zenith Manufacturing Co.

London,
November 19th, 1921.

Current Limiting Simplified.

Your correspondence columns have contained many interesting letters descriptive of current-limiting devices, and claiming particular advantages for each type. I should, however, like to point out that current limiting is a very simple matter, not requiring any separate piece of apparatus.

In an ordinary installation we often have a collection of supplier's switch and fuse, consumer's switch and fuse, meter or limiter, or both. If a contract system of charging is adopted the function of all these appliances can be performed by one fitting, viz., the Heemaf overload switch.

This device is a small inexpensive free-handle overload circuit-breaker. The setting of the overload is adjustable, and can be sealed. It thus gives the supplier and consumer protection against overload, and is a means of isolating the installation. It also acts as a current limiter, because its overload setting is adjustable to such a fine point that, for example, in a six-light installation the switching-in of one additional lamp will cause it to operate. All that is then required to restore the circuit is to turn the switch on again. Could there be anything simpler—or better?

Alan Williams.

London.
November 19th, 1921.

Free Wiring Systems.

I was unfortunate in not being able to be present at Mr. Nisbett's address to the Liverpool Sub-Centre of the Institution of Electrical Engineers on November 7th, but have read his paper and suggestions with regard to assisted wiring and also free wiring of consumers' premises.

The company, whose business I have the honour to control, carried out several hundred "Free-wired Installations" in good class residential property with rents ranging from £45 to £200 per annum between the years 1898 and 1909. Undoubtedly these installations were of great assistance to the company in those early days of carbon-filament lamps and fierce gas competition.

Owing to the lower quality of gas now supplied and the great improvement in electric lamps, I do not think gas competition for lighting purposes a very serious affair in these days.

At the present moment, in spite of bad times and shortness of ready cash, there is a steady and increasing number of new lighting consumers requiring connection to the supply mains. If this is so in bad times, how much more so will it be when materials are cheaper and money less scarce!

For these reasons I do not think a free-wired system is needed in good class districts, and in poor districts where tenants are constantly changing, the difficulty of keeping track of these changes and of obtaining signed and stamped agreements in each case would be very great—and without properly completed agreements the owner of the installation has very little status in cases of dispute.

In the area of the Liverpool District Lighting Co., Ltd., where premises do not often change hands, many installations have been disposed of to new owners when sales of property have occurred.

An extra charge of one penny per unit over and above the ordinary charge for electricity is made, with a minimum of one shilling per point per annum. Allowing an average cost of twenty shillings per point for the installation, this would presumably bring in 5 per cent. per annum provided all the installations were in use. As, however, the cost of the service line has to be included in the cost of the installation and premises are at times untenanted, the rent charges have only amounted to about 3 per cent. per annum of the capital invested.

By the agreements the company is entitled to 5 per cent. per annum as interest on the capital cost of the installation—any surplus obtained being written off the value of the installation which has earned it. In actual practice only a few installations have written their capital account down by this means, and those only very slightly.

Then there is the case in which the installation is scrapped owing to alterations to premises or buildings being pulled down. In this case the installation is lost, and its value has to be written out of the depreciation fund.

In the case of my company a special depreciation fund has been formed to which all the rent pennies received are credited, but it has been found necessary, from time to time, to make additional payments out of revenue to this fund, as with the lower consumption of electricity by the metal-filament lamps a charge of one penny per unit is found to be quite insufficient.

From the foregoing it will be appreciated that a "Free-wiring Scheme" even under favourable circumstances is not self-supporting, and if such were undertaken with the present cost of money and the present cost of installation work, a serious loss would surely be added to the other difficulties of working such a system which, as I have already pointed out, appears to be unnecessary.

Edwin Hansom.

Waterloo,
November 21st, 1921.

The Vapour Accumulator.

In a recent issue you referred to a new accumulator invented by Dr. Ruths, and known as the Vapour Accumulator.

It may interest your readers to know that, as a result of a search at the Patent Office, this invention is found to relate to sulphide digester plants employed in cellulose manufacture, and has no possible connection with electric accumulators.

Bernard Drake.

London.
November 16th, 1921.

A Dynamo Problem.

The cause of "Electron's" dynamo trouble is that the field coils have developed leakage between windings which is impossible to pick up with the usual test.

This can be remedied by treating the coils with insulating varnish and then baking them. If facilities for baking are unavailable, the following is simple, can be carried out very cheaply, and will be found quite efficient: Unwind the tape outer cover (if there is any), pull the windings a little way apart, and submerge them in carriage varnish for about twelve hours; take them out and drain for about three hours. Tape them up and replace them in the machine. When the dynamo is run up do not expect it to take full load immediately, but run for a few hours under light load. In a very short time (about three or four days from the time of submerging in varnish) it will take full load. The first time of running, the coils will most probably warm up, but they will cool gradually, so that no heed need be taken of this. I have, personally, dealt with a dynamo treated with the last method, and have had it running under full load for six to seven months continuously.

F. G. Johnson.

Gillingham.
November 20th, 1921.

I suggest that a very close examination be made of the field windings, both series and shunt, and a test made for—

1. Short circuit between shunt and series coils.
2. Short circuit cutting series coils out of useful action.

No. 2 seems to be the most likely cause of the trouble, for the machine is now behaving exactly as a shunt-wound dynamo would do.

For the aggravation of the trouble I think it quite possible that the arm lifts off the studs when near No. 20, or makes bad contact. It must be remembered that if this happened, the machine would drop its load entirely if the series field was out of action.

Engineer.

November 20th, 1921.

In reply to the letter of "Electron" under the above heading, might I suggest that he thoroughly examines and tests *all* his connections (machines and switchboard) in relation to the series fields, equalisers, and + and − busbars, to make sure that he has not a loose (or hot) connection anywhere, more especially in relation to the machine, the engine of which does

not appear to become overloaded. I may remind him that the *appearance* of a connection is not sufficient proof that it is O.K.

R. Wilson Jones, A.M.Inst.M. & Cy. E.

Harrow,
November 21st, 1921.

[Mr. H. Barham, of Colchester, Mr. R. Swindlehurst, of London, Mr. W. T. Hilder, of Aberdare, "F.W.B.", "T.G.M.", and "C.A.B.", make similar suggestions, which will be forwarded to "Electron."—Eds. Elec. Rev.]

Repairing A.C. Motors.

With regard to the letter of "Jaques" in your issue of October 21st, 1921. The Editors' plan of spinning the stripped rotor in a suitable magnetic field would undoubtedly decide the state of the insulation of the rotor laminations. The stator, however, presents a different problem.

Apparently in "Jaques's" case the rotor is in order, and it is the stator which will have to be tested.

Assuming the insulation between the core stampings of any a.c. apparatus to have been destroyed subsequent excessive heating of such a core would most probably be due to eddy currents.

In taking efficiency tests, energy absorbed in generating eddy currents is tabulated as a loss under the heading, Iron Losses.

Let "Jacques" then treat his a.c. motor as a transformer which he intends to test for iron losses.

If the stator is sound (as apparently it is), disconnect, or place the stator windings on open circuit. If unwound, or stripped, so much the better. Build up the machine as for running, but lock the rotor so that it cannot turn, connect the rotor slip-rings to a suitable a.c. supply (the voltage of which should approximate to the open circuit rotor volts) through a resistance by means of which regulate the current until it approximates to full load rotor current.

Full rotor currents will give approximately full magnetic flux density in both rotor and stator cores, at the periodicity of the supply, and defective insulation will soon be apparent in the excessive heating of the iron, by the eddy currents generated or stator iron losses. In case of difficulty in obtaining a supply at suitable voltage, lock the rotor of another similar motor, and use it as a transformer, the stator being the primary and the rotor the secondary. Other methods may suggest themselves to "Jaques." Of course the foregoing method is only practicable if the motor has a slip-ring rotor or if a suitable slip-ring rotor can be obtained.

Tanner.

November 16th, 1921.

BUSINESS NOTES.

Bankruptcy Proceedings. — William Edwin Charles Jarvis, 3, King Edward Street, Darlaston, lately trading as the Darlaston and District Electrical Engineering Co., 48, King Street, Darlaston, Staffordshire, electrical engineer. The first meeting of the creditors was held on November 16th at the Official Receiver's office, 30, Litchfield Street, Wolverhampton. The liabilities were returned at £283, against assets £18. The matter was left in the hands of the Official Receiver as trustee.

T. D. Waring, electrical engineer, 55, Walmgate, York.—Receiving order made November 14th on debtor's own petition. First meeting November 29th at the Official Receiver's offices, Dunscomb Place, York. Public examination December 16th at the Law Courts, York.

C. P. M. Downie (P. Downie), electrical engineer and factor, 355a, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea.—Discharge suspended for two years as from October 17th, 1921.

G. Dolby, electrician, 39, East Marsh Street, and 129, Freeman Street, Gt. Grimsby.—Trustee, J. F. Wintringham (Official Receiver), St. Mary's Chambers, Gt. Grimsby, released October 31st, 1921.

J. W. Layton, electrician, 5, Nobles Bank, Hendon, Sunderland.—Trustee, W. A. Ellis (Official Receiver), 3, Manor Place, Sunderland, released November 2nd, 1921.

F. A. S. Wormull, trading as the Lewisham Electric Wiring Co., 273, High Street, Lewisham, electrical engineer.—The public examination of this debtor was held recently at the Court House, Greenwich. Debtor stated that he commenced business in January, 1919, with £150 capital, which was all absorbed in opening the premises. In 1919 his losses amounted to £279, and in the following year to £706. In 1919 the sales amounted to £2,188, while in 1921 they rose to £2,451. The liabilities were returned at £2,763, against assets £261. Debtor attributed his failure to heavy administrative expenses, lack of proper supervision of outdoor staff, losses incurred through inaccurate tendering for contracts carried out, trade depression, and the action of the trade unions in increasing wages. The examination was adjourned.

W. Bennett, electrical contractor, Back Sitwell Street, Derby.—Receiving order made November 18th on debtor's own petition.

M. Watkinson, H. Watkinson, and A. Watkinson (Watt and Co.), electrical and mechanical engineers, 22 and 24, Palmer Road, Sheffield.—Last day for proofs for dividend, December 8th. Trustee: Mr. T. C. Parkin, Jun., 36, Bank Street, Sheffield.

Joseph Owen, trading as J. Owen & Sons, 186, Westcombe Hill, Greenwich, Kent, and 3, The Grove, Greenwich, electrical engineer.—The first meeting of creditors was held on November 18th at 29, Russell Square, W.C.1. The receiving order was made on debtor's own petition on November 7th. According to the statement of affairs the ranking liabilities amounted to £1,294, against net assets estimated to realise £289, leaving a deficiency of £1,005. Debtor started business in December, 1916, as an electrical engineer, and was successful until December, 1920, when the business declined owing to trade depression, followed by the coal strike. There was not a quorum of creditors present at the meeting, and the case, being a summary one, was left with the Official Receiver as trustee of the estate.

Company Liquidations.—Stoneycroft Electrical Works, Ltd.—Particulars of claims to the liquidator, Mr. E. Chetter, 26, North John Street, Liverpool, by December 28th.

Strachan, Oswell & Co., Ltd., London, E.C.—Meeting of creditors, Friday, December 2nd, at Institute of Chartered Accountants, Moorgate Place, E.C. 2. Liquidator: Mr. W. W. Read, 44, Gresham Street, E.C.

Wellman, Head, Stothert & Pitt, Ltd.—Winding up voluntarily. Liquidator: Mr. C. J. Barker, 36/38, Kingsway, W.C.2.

Dubilier Condenser Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator: Mr. F. W. Hollings, Ducon Works, Goldhawk Road, W., who is authorised to enter into an agreement with a new company, Dubilier Condenser Co. (1921), Ltd.

Dissolutions of Partnership.—T. Baker & Co., electrical engineers, 93, Upperton Street, Leicester.—Mr. T. Baker and H. A. Lock have dissolved partnership. Debts will be attended to by Mr. C. H. Bolton, 22, Millstone Lane, Leicester. Mr. T. Baker will continue the business.

Accumulator Service Co., manufacturing electricians, 83, Forest Street, Forest Gate. Mr. S. T. Jolley and Mr. W. D. Eves have dissolved partnership.

Trade Announcements.—Messrs. Electrical Utilities, Ltd., have arranged an agreement with Electrical and Engineering Development, Ltd., whereunder they acquire the whole capital, patents, business, goodwill, and other assets of the latter company. Upon the formal completion of the sale, Electrical and Engineering Development, Ltd., will go into voluntary liquidation.

The Cable Accessories Co., Ltd., has removed its London office to 13, Cursitor Street, Chancery Lane, E.C.4 (Mr. Charles Lang, London manager). A range of "Revo" electrical manufactures is on exhibition.

Messrs. Friend, Wintle & Co., 8, Park Street, Cardiff, are opening an electrical showroom in St. Mary Street, Cardiff.

Messrs. Bilham & Kidney have opened showrooms for electrical goods in Pound Street, Carshalton.

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 23rd:—Copper (electrolytic) bars £76, 10s. decrease; ditto sheets, no change; ditto wire rods £92, 10s. decrease; ditto h.c. wire, no change; silicium bronze wire 1s. 2½d., ¼d. decrease.

Messrs. James & Shakespeare report November 23rd:—Copper cars (best selected), sheet and rod, no change; English pig lead, £26 5s., increase 20s.

Catalogues and Lists.—Messrs. Edward le Bas & Co., London.—A hanging card which, on one side counsels us all to "Be Happy, Smile, Make Life Worth While," and on the other side gives tabulated prices of welded gas, steam and water tubes and malleable fittings.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—An illustrated leaflet giving revised prices of generator and battery switchboards.

Messrs. Isaacson & Brown, Ltd., 39, Furnival Street, Holborn, E.C.4.—An illustrated leaflet giving revised prices of copper earthing clips. Also a priced sheet of electrical fittings, including tumbler switches, bell pushes, lamp holders, &c.

Materiel Electrique Alex Lefebvre, 9, Rue Arsène Houssaye, Paris (VIIIe.). "Special Bargain List," No. 53, a catalogue of British-made machinery for disposal in France, including generating plant and other electrical machinery.

Mr. J. B. Rudkin (representing Sprecher & Schuh Co., Switzerland), 212a, Shaftesbury Avenue, W.C.2.—An illustrated booklet describing a number of switches and fuses of various types.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, E.C.1.—An illustrated price list of electrical heating and cooking appliances, including kettles, irons, grills, fires, toasters, &c.

Messrs. A. Verey & Co., Ltd., 27, Buckingham Gate, Victoria Street, S.W.1.—An illustrated price list of numerous electrical appliances and accessories, including lanterns, bowl fittings, lamps, fires, kettles, &c.

Messrs. Williams, Pell & Baring, 4, Regent Square, W.C.1.—Descriptive Leaflet No. III. 1, illustrating and giving full details of small automatic overload switches made by Heemaf, Holland.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list for November giving full particulars of d.c. motors.

Messrs. L. G. Hawkins & Co., 116, Charing Cross Road, W.C.2.—Folder No. 760 illustrating and describing the "Universal" electric washer and wringer. Priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet O.S. 2,588, illustrating and describing the "Atrax" advertising sign projector. Priced.

The Globe Engineering Co., Ltd., Brighouse, Yorks.—Owing to an error, the list mentioned in this column in our last week's issue was stated to deal with a.c. plant, whereas it was a catalogue of direct-current motors and dynamos.

Book Notices.—"The Book of the Ford," by R. T. Nicholson, M.A. (286 pp. illustrated). London: The Temple Press, Ltd. Price 3s. net. (6th edition).—The latest edition of this little volume, which, it is said, has so far had a circulation equal to the number of Ford cars sold in this country, has been entirely re-written. The electrical equipment is dealt with where necessary, but it has been found advisable to treat of this subject fully in a separate volume. Written in terms easily to be understood by the average owner, this book is of great value to the ever-increasing army of drivers of the car which has survived such a flood of humour.

"The Rights of the Ex-Service Man and Woman," by Wilkinson Sherren. (111 pp.). London: L. J. Gooding. Price 6d. net.—In a preface to this handbook the Rt. Hon. C. A. McCurdy, K.C., M.P., says that it has been impossible to make those who were entitled to them fully acquainted with their rights with regard to pensions, gratuities, &c. He gives a short summary of what has already been done for ex-Service men and women, and thinks that Mr. Sherren's work will be of great assistance to them. The work sets out very fully details of disability pensions and methods of assessment; employment is dealt with; land settlement and overseas settlement are treated of in a fairly adequate manner; and many points of lesser importance are touched upon.

"*Journal* of the American Institute of Electrical Engineers," Vol. XL, No. 11, November, 1921. New York: The Institute. Price 1s.

"Alternating Currents," Part I, by C. G. Lamb, pp. xiii+74, 61 figs. Price 5s. 6d. net. Part II. pp. iv+128, 82 figs. Price 7s. 6d. net. Cambridge University Press.

"The Emission of Electricity from Hot Bodies," by O. W. Richardson, F.R.S. Second edition, pp. viii+320; 35 figs. London: Longmans, Green & Co. Price 16s. net.

"Fuel and Lubricating Oils for Diesel Engines," by W. Schenker, pp. xii+114, figs. 26. Price 10s. "Modern Methods of Welding as applied to Workshop Practice," by J. H. Davies, pp. xviii+263, 132 figs. Price 21s. London: Constable & Co., Ltd.

"Science Abstracts, A. & B.," Vol. XXIV, No. 286, Part 10, October 31st, 1921. London: E. and F. N. Spon, Ltd. Price 2s. 6d. each net.

"Electric Clocks and Chimes—a Practical Handbook on their Design and Construction," pp. 159, 153 figs. London: Percival Marshall & Co. Price 3s. 6d. net.

Inquiry.—The makers of a device for arousing a sleeper and simultaneously starting a water heater ("The Sluggard's Comfort") are asked for.

Registration of Electrical Contractors in Australia.—The Electrical Contractors' Association of New South Wales has requested the State Government to introduce legislation licensing persons who control the industry.

At the annual dinner of the association, in September, Mr. G. Cann (Minister for Labour and Industry) said that he would promise, if the Government were spared, to place on the statute book a law in the direction indicated. As far as he was concerned he would do his level best to put through legislation on the basis of efficiency above all things. He was of opinion that certificates should be issued to the men, after a thorough examination, that they were competent to do the work. He had no time for the "go-slow" or sabotage policy. —*Sydney Morning Herald.*

Catalogues Wanted.—Messrs. Kyffin Hughes, lighting and heating engineers, 4, The Poultry, Nottingham, who contemplate opening an electrical department, desire to receive catalogues of electrical specialities.

Messrs. Teesdale & Jones, electrical contractors, 17, North Street, Swindon, wish to receive catalogues and lists of electrical goods.

Social Event.—Mr. W. E. Hobbs, district manager, presided on Saturday at a "coming-of-age dinner," held at the Royal Hotel, Cardiff, in connection with the local branch of the General Electric Co., Ltd. Mr. M. J. Railing (director and general manager), together with Mrs. and Miss Railing, was present, as also was Mr. H. N. Whitford, the branch representative at headquarters. The function was attended by about seventy members of the local staff. Mr. Hobbs said he considered that, after passing through a trying year, when everyone had been blaming the other fellow for being responsible for the slump, it was a good thing for the staff, management and directors, to meet together in that manner. Mr. Railing said he believed the reason why the General Electric Co. had not felt the depression as much as many other industrial concerns was because the staffs had realised hard, unpleasant facts, and were adjusting themselves more quickly.

The Trade Ship "British Industry."—The directors of the "British Trade Ship," of which Earl Grey is chairman, announce that provisional tenders are being obtained by the builders of the ship for the various parts and fittings. Exhibitors who are in a position to supply some part or fitting as an exhibit actually in use on board, quite apart from their display in the exhibition proper, are naturally anxious to have their products accepted for this purpose. At Wallsend-on-Tyne, where the ship will be built, and at the offices of the British Trade Ship, 12, Grosvenor Gardens, London, S.W. 1, the examination of specifications is taking place, and is of considerable interest as revealing the place of different cities in the construction and equipment of the "Trade Ship." Birmingham wants its bedsteads in the best cabins; Kidderminster its carpets; Bradford its textiles; Sheffield its cutlery; and so on with machinery, electrical goods, &c., and the directors of the "Trade Ship" are inundated with offers to provide exhibits which will be actual fittings of the ship. When arrangements have been completed the names of the chief firms responsible for the various component parts of the Trade Ship will be published.

Italian Companies.—There has been formed at Rome the Compagnia Italiana dei Cavi Telegrafici Sottomarini, with a capital of 1,000,000 lire, for the working of submarine cables joining Italy with Spain, Brazil, Uruguay, and Argentina.

At Turin has been embodied the Società Consorzio Impianti Trazione Elettrica to carry out the electrification of railway or tramway lines. Capital, 1,000,000 lire.

French Railway Work.—The French Thomson-Houston Co. is in negotiation with the Orleans Railway Co. for the supply of 200 electric locomotives, and an agreement is said to be on the point of being reached. At present the former is engaged on the manufacture of sub-station plant for the Southern Railway Co., and has in view the possible delivery of rolling stock for the Paris, Lyons, and Mediterranean Railway. The share capital of the electrical company is shortly to be raised from 200 to 250 millions of francs so as to provide for the extension of the industrial programme.

A French Amalgamation.—The directors of the Société d'Electro-Chimie et d'Electro-Metallurgie, and of the Compagnie des Forges et Aciéries Electriques Paul Girod have decided to recommend their respective share-holders to agree to an amalgamation of the two undertakings by means of an interchange of shares on the basis of three shares of the former for five of the latter company.

The Gothenburg Exhibition.—A message from Gothenburg states that work has been begun on the erection of the large halls for the export section of the coming exhibition. The length of the halls is 230 and 200 metres respectively. These halls form only part of a space totalling 16,000 sq. m allotted to the export section.—*Reuter's Trade Service* (Stockholm).

Strike at Dusseldorf.—Sixty thousand iron and steel workers have gone on strike in the Dusseldorf area for an increase of wages. In some cases a 100 per cent. increase was asked for. The masters replied by declaring a lock-out.—*Reuter's Trade Service.*

For Sale.—By order of the liquidators, Messrs. B. Norman & Son will sell by auction on November 30th, at 5, Little Britain, E.C., the machinery and fittings of Tele News (1914), Ltd., including motors, dynamos, generators, &c.; on December 1st at 62, South Eaton Place, S.W., instructed by the liquidator of T. B. L. Electric Construction Co., Ltd., Messrs. Leopold Farmer & Son will sell a quantity of electrical accessories and fittings, lamps, switches, &c.

Offers are invited for the lease, plant, and machinery, stock-in-trade, materials, &c., of the Victory Alarm Clock Co., Ltd. (in liquidation), of 274, Kentish Town Road, N.W.

Wigan Corporation Electricity Department has for disposal three reciprocating sets.

Assets Auctions Co., Ltd., will sell by auction on December 1st, at 119/121, Newington Causeway, S.E., remainders of various electrical stocks. (For full particulars see our advertisement pages to-day.)

E.D.A. Activities.—The British Electrical Development Association has issued a circular letter (E.D.A. 223) to managers of electricity supply undertakings, pointing out that the electric pastry oven is now a commercial success and a valuable addition to the station load. Accompanying the letter are extracts from testimonials of users of electric pastry ovens. These include restaurant and hotel proprietors, manufacturing confectioners, bakers, &c.

Local Electrical Exhibitions.—Messrs. Renton, Edinburgh, have a very complete exhibit of electric labour-saving appliances for the home, such as sweepers, cookers, toasters, heaters, irons and kettles at the Grocery Exhibition being held in Edinburgh. The "Gem" Labour-Saving Device Co. has also on view some novelties in the electric suction cleaner line. Computing and weighing machines worked by electricity are exhibited by Messrs. Parnall & Sons, Ltd., Birmingham.

An electrical exhibition at Blackburn, arranged by Mr. P. P. Wheelwright, borough electrical engineer, has proved a great success. There have been visitors from towns far and near, and the use of electrical devices is likely to be considerably encouraged.

Messrs. Stephensons, Ltd., hardware dealers, of Kirkgate, Wakefield, are making a special feature of domestic electrical appliances, and are giving demonstrations of electric labour-saving apparatus in the home for a fortnight. The equipment includes electric clothes washers and wringers of clothes, dishwashers, vacuum cleaners, sewing machines, irons, &c.

An exhibition arranged by Mr. J. Turner, superintendent of the Council's electrical department, was held recently at the Hoylake and West Kirby Town Hall. The authorities were not in any way connected with the sale of the articles, but simply co-operated with firms of local electrical contractors, with a view to giving the numerous labour-saving exhibits an attractive display. Amongst the exhibits were electric cookers, fires, lamps, irons, and many other appliances.

Electrical Installations in Sydney.—The Sydney City Council recently resolved that, on and from a date to be fixed, all installations which it is intended to connect to the Council's mains must be installed by men who are certified by the secretary of the Electrical Trades Union of Australia, such men to be financial members of that organisation, and the consumers must produce a certificate to that effect before the Council will grant supply. Failure to produce such a certificate will render the consumer liable to a fine, and supply of current will be withheld until the fine is paid. It was intimated that notice to rescind the motion would be given.—*Sydney Morning Herald.*

Electrical Salesmanship.—The second of the series of lectures on salesmanship being arranged by the E.D.A. will take place at the building of the Chartered Institute of Patent Agents on December 16th, at 8 p.m. Mr. E. R. Morton will lecture on "Salesmanship in Relation to Electric Power-Driven Machinery in the Home." Mr. S. T. Allen will again occupy the chair.

Attracting the Consumer.—We have not lately seen an "all-electric" newspaper page, a form of collective advertising very popular in the United States, but last week we were gratified to see a whole page of the *Daily Mail* devoted to electricity. Among the advertisements of several prominent electrical apparatus and lamp makers, appeared a short talk on "Electricity the Perfect Servant," by the chairman of the Council of the E.D.A. (It was, of course, the E.D.A. which arranged the display.) The scheme is bound to prove advantageous to the industry as such a paper as the *Daily Mail* has a large circulation and reaches all classes, and the grouping of the advertisements gives each item an advantage not possessed by a similar advertisement surrounded by irrelevant matter.

Auxiliary Machinery for Diesel Engine Ships.—Messrs. W. H. Allen, Sons, & Co., Ltd., have secured from Messrs. Harland & Wolff a licence for the manufacture of Diesel engines under Messrs. Burmeister & Wain's patents. The engines will be made to jigs, tools and fixtures under a system of detailed inspection to secure accuracy, interchangeability, and rapid production, and this work will be carried out in special fitting and erecting shops. These, we understand, are fully equipped, and also have the latest appliances so that the engines may be tested as nearly as possible under actual working conditions. The engines will be made in sizes to conform with present-day requirements, and Messrs. Allen are specialising particularly in the supply of Diesel electric generating sets for auxiliary and emergency purposes on board ship. Messrs. Allen hope shortly to be in a position to supply auxiliary air compressors under the same licence, and they are laying themselves out to provide the other auxiliaries which go to form the complete equipment of a ship's Diesel engine room. The machinery that they are about to construct will comprise Diesel auxiliary engines, Diesel engine-driven generators, auxiliary air compressors, motors for driving compressors, motors for sanitary, ballast, bilge and cooling purposes, motors required in connection with refrigerating machinery, steering gear, hoists, and all descriptions of winches, and centrifugal pumps for all purposes.

Wage Reductions.—During October over 2,100,000 workpeople were affected by reported changes in wage rates. Of these 1,700,000 sustained decreases, and 400,000 received increases. The net effect was a reduction in weekly full time wages of £430,000. The groups chiefly affected were miners, blast furnace workers, iron puddlers, and iron and steel millmen, shipyard workers, foundrymen, hosiery workers, textile dyers, bleachers, and workers in the heavy chemical and soap and candle trades.

It is estimated by the Amalgamated Engineering Union that a reduction of about £50,000,000 will be made in the annual wages cost as a result of the ballot decision of the members of the engineering and shipbuilding Unions to accept the withdrawal by instalments of the 12½ per cent. and 7½ per cent. Ministry of Munitions bonus. They express the hope "that the employers' anticipation of an early revival in trade will be realised, thus finding employment for the large number of unemployed workpeople.—*Morning Post.*

Electric Trucks.—Messrs. Roadcraft, Ltd., manufacturers of electric trucks have under consideration plans for an extensive factory. A consignment of six electric "Trojan" trucks has just been dispatched to the Continent. At their present factory work is proceeding on a new type of electric barrel lifting truck.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries:—

O.L.M. (lettering and design). No. 418,687. Class 13. Ignition plugs for explosive motors, &c. Officine per Lavorazioni Metallurgiche e Meccaniche, 4, Via Pestalozzi, Milan, Italy. October 20th, 1920.

Paralité. No. 413,747. Class 13. Vulcanite goods. The Tough Leather Co., Ltd., 447, Wincolmlee, Kingston-upon-Hull. March 24th, 1921.

Crypto. No. 408,423. Class 6. Induction motors, rotary transformers, and motor generators, all being electrical machinery. The Crypto Electrical Co., Ltd., Acton Lane, Willesden Junction, N.W. October 7th, 1921.

Alternupoche. No. 415,751. Class 13. Pocket lamps (ordinary). Lucien Rosengart, 61, Boulevard Soult, Paris, France. May 31st, 1921.

Osglim. No. 416,399. All goods in Class 13. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. June 24th, 1921.

Autopet. No. 417,585. Class 16. Automatic electric generating plants. Petters, Ltd., Nautilus Works, Yeovil, Somerset. May 10th, 1921.

Win-Sum. No. 418,374. Class 18. Electric fire stoves. Tidd, Siday & Co., Ltd., 180, Drury Lane, London, W.C. September 7th, 1921.

A Derby Installation.—The Palais de Danse recently opened at Derby has been fitted throughout with electric light lanterns and shades of "Celastoid" in various colour effects and shapes. Celastoid is made of cellulose-acetate, by the British Cellulose and Chemical Manufacturing Co., Ltd., of London.

Telegraph Material in Russia.—It is reported from Moscow under the date of November 13th, that telegraph and telephone apparatus is beginning to arrive from Sweden, Germany and England.

Patent Application.—The Radio Communication Co. Ltd., has applied for the grant of a compulsory licence in respect of the following patents: No. 6,203 of 1907, "For improvements in electric signalling," granted to R. A. Fessenden; and No. 24,458, of 1913, "For improvements in the utilisation of oscillating current energy, particularly applicable for wireless telegraphy," granted to J. W. Lee and another.

German Trade with Japan.—Reports show that German machinery suppliers are steadily regaining the markets in Japan. Immediately after the war, it is said, Japanese machinery orders were placed with Germany only for special goods peculiar to German manufacturers. Subsequent trial orders, however, have proved that the machinery is equal to that produced prior to the war, and is offered at prices lower than British and American goods. Principally orders for scientific and chemical machinery used in laboratories, it is said, are reaching Germany from Japan.

Chinese Notes.—A Tientsin merchant has petitioned the Ministry of Agriculture and Commerce for approval to form a company for the construction of tramways between Peking and Tientsin. An electric plant will be installed at Hwailai, and power will be generated from the Yungting River. It is expected that electricity will also be supplied from this source to the factories *en route*. The permission of the Ministry has not yet been given.

The Ministry of Agriculture and Commerce has registered the revised regulations of the Chi Tsi Electric and Waterworks Company of Hankow.

The Fu Sin Electric Co. of Shen Tseh, Kiangsu, and the Changsu Electric Co. of Changsu, Kiangsu, have been registered by the Ministry of Communications.

Hu Chung-shih and Wu Siao-peng are organising the Hsin Yih Machine Manufacturing Co., with a capital of $150,000, which will be situated at Men Tou Kou. The company will manufacture machines and nails.

Italian Trade Activity at Riga.—The Italian Foreign Trade Limited Liability Co. has opened a branch at Riga. The company represents 23 large Italian concerns, with 80,000 workmen and a capital of 500,000,000 lire. Among the Italian firms represented are Messrs. Pirelli (rubber, cable, telephone and telegraph works), and Messrs. Marelli (electrical machinery).—*Reuter's Trade Service* (Riga).

The Situation in Chile.—Reports recently received from all parts of the country tend to confirm the opinion held by prominent business men in Santiago that the commercial outlook in Chile is brighter than it has been for many months.

The announcement is made that English and Chilean interests have completed financial arrangements for the construction of a railway between Los Andes, Santiago, and Valparaiso.

The Chilean Electric Tramway and Light Co. and the National Electric Power Co. have recently amalgamated with a combined capital of £12,000,000 sterling. The bulk of the capital is English.

Representatives of the Italian Government, who announced, in September, that direct cable communication between Italy and Latin-America would soon be established, now state that a cable between Italy and Brazil will be laid within two years. It is proposed later to extend the line to the Pacific Coast of South America. The cable will be exclusively Italian. —*Reuter's Trade Service* (Santiago).

Employment Exchanges.—Dr. MacNamara, Minister of Labour, stated in Parliament on November 10th, that he had been reviewing the question of employment exchanges, and by the end of the year would have closed 185 branch offices. How the needs of the population in industrial areas, particularly in the administration of the unemployment insurance benefit, could be met without the exchange system he could not understand.—*Daily Mail.*

Patent Restoration.—Messrs. W. Negus, A. Tony, J. Guerritte, N. Merz, and A. Reyrolle & Co., Ltd., have made application for the restoration of Patent No. 19,851 of 1910, "For improvements in electrical cut-outs," granted to A. C. Reyrolle and A. Reyrolle & Co., Ltd..

The Trade of Algeria.—Reporting on the trade situation in Algeria, the Acting British Consul-General at Algiers, says: "A limited market will be found for the products of certain branches of the iron and steel industry (*e.g.*, tools, wire, mining requisites, anchors and chains), and of the machinery and electrical trades, and in leather belting."

LIGHTING AND POWER NOTES.

Accrington.—Electricity Supply Extensions.—The Electricity Committee has received a letter from Blackburn Corporation stating the terms on which it will supply electricity or undertake a stand-by service to Accrington. The suggestion is that all electricity should be metered at Jubilee Street (Blackburn), and if a supply to Accrington proves necessary, to run the plant at Jubilee Street Station. At the recent inquiry by Mr. Robert Blackmore, technical adviser, and electrical engineer to the Stalybridge-Mossley Joint Station, he stated that by taking power from Blackburn, Accrington would lose £10,000 a year. The cost of cable-laying and equipment alone will be £9,000 per mile, giving a total cost for Whitebirk of from £40,000 to £45,000. Further steps are being taken to obtain the Electricity Commissioners' sanction to borrow £150,000 for extensions.

Australia.—Electrical Developments.—The New South Wales Cabinet has agreed to issue the prospectus of a loan of £80,000 in order that the electricity undertaking on the Clarence River, known as the Nymboida hydro-electric scheme, may be carried out. The station will supply all the extreme north coast towns in the State with electric power.

Various municipal bodies in Northern Tasmania are asking for an official report on the possibility of generating electricity from the North Esk River. The estimated cost of connecting the coast with the Government scheme is £250,000; the annual charge would be £6.10 per h.p. It has been proposed that power could be obtained from the vicinity of Cradle Mountain. Devonport has agreed to take 2,000 h.p., Ulverstone, it is suggested, should be able to absorb 500 h.p., and Wynard 300 h.p.

The Picton, (N.S.W.) Council is borrowing £7,000 in order to install an electrical service, and the Murray River town of Echuca is borrowing £16,000 for a similar purpose.—*Reuter's Trade Service* (Melbourne).

Axminster.—Electricity Supply.—Steps are being taken to form a local company for the supply of electricity to the town.

Barmouth.—Electricity Supply.—With a view to finding work for the unemployed, the Urban Council is urging the continuance of the electricity supply scheme at Aber Artroo, upon which £22,000 has already been spent. The scheme, which is being promoted by Mrs. Prys Owen, of Llanbedr, who is defraying all expenses, has been held up for some months owing to the delay in obtaining a Special Order.

Beckenham.—Loan.—The Electricity Committee has decided to apply to the Electricity Commissioners for sanction to the borrowing of £5,349 to cover the balance of the expense incurred by the installation of a new turbine.

Continental.—Czecho-Slovakia.—The Government has decided to introduce a tax on utilised water-power. Only plants of 2 h.p. or under will be exempt, and the tax will be levied according to the size of plant and hours of working.

Denmark.—Mr. S. A. Faber, at a meeting of the Danish Association of Engineers, put forward a new scheme for the electrification of Denmark. The project is based upon the co-operation between all the big supply works in the matter of high pressure in connection with the supply of electricity from Norway via North Jutland. According to the scheme the pressure in the main conductors would be 50,000 volts, and the mains would proceed from Aalborg and be led over Randers, Aarhus, Horsens, Vejle and Fredericia to Strib and thence over the islands. Mr. Faber originally conceived the idea of the formation of a community of interests which would have absorbed the existing works in one way or another—under control of the State—but continued investigations showed that it would scarcely be possible to bring about such co-operation, and under the circumstances the question is now being considered whether the most appropriate method would not be for the State to take over and carry on such an important network of mains.

Latvia.—As all coal supplies have to be imported from abroad and at the present low exchange rate of the rouble are very costly, Latvians have turned to local sources of power—water and peat. The chief source of water power would be the river Daugava, but the cost of development is beyond the means of local enterprise and will have to await the aid of foreign capital. In the meantime, several limited liability and co-operative societies have been formed with a view to utilising the water power of the smaller rivers. The generating plants are estimated to produce from 500 to 10,000 h.p. Already four such companies have been formed on the rivers Jugla, Brasla, Amata, Gauja, all in Livonia. Courland, being mostly flat country, has no rapid rivers, but there are extensive peat bogs in the vicinity of various towns. Several communities are planning the erection of peat-fired generating plants to be utilised for driving mills, and small factories and agricultural machinery, and for lighting.—*Reuter's Trade Service* (Riga).

Russia.—According to reports from Petrograd, Allmaenna Svenska Elektriska Aktiebolaget has been granted a concession to build electricity works at Yaroslav on the Upper Volga.—*Reuter's Trade Service* (Stockholm).

Darlington.—Reduced Charges.—The Electricity Committee has decided to reduce the charges for electric lighting from 4½d. to 4d., and for power by 10 per cent.

Dundee.—Cheap House Wiring.—The offer of a two-part tariff to electricity consumers as an alternative to the flat rate, a fixed charge based on floor area plus ½d. per unit, has not met with a very large response. As far as prospective consumers are concerned, this is thought to be due to the high cost of installation. The Corporation Electricity Department has therefore fitted up a seven roomed house in Broughty-Ferry, including the usual scullery, kitchen, and bathroom, in order to demonstrate the utility of electricity. Major H. Richardson, the engineer, explaining the method of wiring adopted, a simple surface one, points out that expensive ceiling fittings or electroliers are unnecessary, and that a complete installation for lighting, heating, and cooking, can be carried out quickly in houses at present using other methods without a great deal of preliminary work, and much more cheaply than any other system. It is also claimed that the present elaborate system of switching and fittings is done away with. Mr. Richardson also states that the new system obviates a great deal of damage which was caused through lights hanging from the roof, and the new wiring, while practically indiscernible, has a large current-carrying capacity, and fully provides for all the uses that electricity can be put to in the home.

Friern Barnet.—Electricity Supply.—The surveyor to the District Council is preparing a report regarding the possible supply of electricity to the district by the North Metropolitan Supply Co., or the Hornsey Electricity Committee.

Gelligaer.—Electricity Supply Scheme.—A letter from the general manager of the Powell Duffryn Colliery Co., stating that, owing to the unreasonable attitude of the Council on other matters, he could not recommend his directors to consider the question of supplying electricity to Fochriw was read at a meeting of the Gelligaer Council on November 15th. It was stated that the communication would involve the Council in the expenditure of thousands of pounds. A deputation is to wait upon the company.

Llanfairfechan.—Scheme Rejected.—The Council has decided not to proceed with the electric light scheme which it was estimated would cost £10,000.

Lower Walton.—New Sub-station.—At a meeting of the Lower Walton Council, it was reported that the powers provisionally vested in the Mersey Power Co. had been transferred to the Warrington Corporation, and the plan of the sub-station to be erected in West Avenue by the latter authority was recommended for approval.

Lossiemouth.—Increased Charges.—The Town Council has decided to increase the charges for electric heating from 2d. to 3d. per unit, and for power from 3d. to 4d. per unit.

Maidstone.—Electricity Supply to Hospital.—The County Council has decided to expend £1,300 on a scheme for the supply of electricity to Barming Heath Mental Hospital, by which it is estimated that there will be an annual saving of £1,500 on fuel and gas.

Middlesbrough.—Breakdown.—A failure of the electricity supply at Middlesbrough on November 14th, held up the working of the Transporter Bridge which spans the Tees. Large numbers of workmen were stranded on each side of the bridge. In order to be able to keep the transporter car running in any future event of this nature, the Corporation is having separate generating machinery installed.

New Zealand.—South Island.—The *New Zealand Times* reports that Mr. H. B. Hall, architect, of Timaru, has made an examination of Lake Tekapo as a source of electricity supply. He finds that a fall of 80 ft. can be obtained, which with a minimum lake discharge of 4,000 cusecs would give 30,000 h.p. at the turbines. He proposes overhead transmission at 55,000 V, via Mackenzie Pass (fifteen miles), and then forty miles to Timaru. He estimates the cost of a tunnel, power house, and transmission line at £400,000 and distribution to every house in the district at £240,000, a total of £40 per h.p.—*Reuter's Trade Service* (Melbourne).

Shipley.—New Plant.—On November 19th, the chairman of the Council started up a new 1,000-kW rotary converter. This machine was made by the English Electric Co., and is a good example of up-to-date practice. The chairman spoke of the steady progress of the electricity department, which now has over 1,500 customers, and prophesied that after the depression in trade had passed away the consumption of electricity would increase rapidly and consistently.

Skipton.—Electricity Supply.—The District Council received and approved, last week, a report on negotiations with Keighley Corporation with a view to the supply of electricity to the town from Keighley. The provisional plans provide for an estimated capital cost of £15,000.

Worcester.—Proposed Purchase of Plant.—Subject to the receipt of the Electricity Commissioners' sanction, the City Council has decided to purchase some generating plant at Southampton from the Disposal Board. The estimated cost of purchase and installation is £55,850.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness.—Year's Working.—The annual report of the tramway department for the year ended March 31st last shows a total revenue of £47,667. Working expenses amounted to £48,338. After deduction of capital charges, &c., there was a net deficit of £13,615.

New Cars.—Two of the twelve new tramcars ordered by the Corporation have been delivered, and delivery of the remainder is expected within six weeks. The cars will cost £2,227 each. The bodies and trucks are being built by the Brush Electrical Engineering Co., of Loughborough, and the electrical equipment installed by the English Electric Co., of Preston. The cars are single-deckers, seating 32 passengers. A saving of £6,000 to £7,000 per year is anticipated when the twelve cars are in service.

Canada.—Montreal.—According to the *Electric Railway and Tramway Journal*, the plan and route for an underground railway have been outlined by Mr. F. S. Williamson, a prominent engineer. It is estimated that a subway system would cost about 25,000,000 dols., and that in the course of a year the Montreal tramways, which would operate the scheme, could handle 300,000,000 passengers.

Carnarvon.—Light Railway.—The Town Council has decided, subject to the consent of the Ministry of Transport, to commence the scheme for the extension of the North Wales Narrow Gauge Railway from Dinas to Portmadoc, and also to Carnarvon. £290,000 has already been spent on this line, and it is estimated that an additional £120,000 is required to complete it. The scheme will provide work for 830 men.

Glasgow.—New Route.—The general manager of the tramway department has been asked to prepare a report regarding the possibility of laying a track between Clydebank and Duntocker.

L.B. & S.C. Railway.—Projected Electrification.—The last issue of *Modern Transport* gave particulars of the electrification schemes projected by the London, Brighton & South Coast Railway Co. It is proposed to proceed at the earliest favourable opportunity with the electrification of the lines from London to Brighton, Worthing, Seaford, and East bourne. The system used will be high-pressure, single-phase current with overhead collection. In addition to the speeding-up and augmentation of services, the change will bring substantial financial gains, as the company's experience in the past has proved.

London.—Lower Fares.—The London United Tramways announce that owing to the success of the cheap return fares on their Tooting and Hampton Court route, the facility was extended on November 16th to the Richmond Bridge and Kingston route.

New Zealand.—Wellington.—The annual report of the general manager of the tramways undertaking (Mr. W. H. Morton), shows a total revenue of £347,695. Working expenses amounted to £289,320, leaving a gross profit of £58,375. After deduction of capital charges there was a net profit of £3,232.

Preston.—Christmas Holiday.—The Tramways Committee has resolved not to run cars on Christmas Day.

Reading.—Extension of Time.—The Minister of Transport has extended the time of the Reading Corporation Act, 1914, for the completion of tramways, until July, 1923.

TELEGRAPH AND TELEPHONE NOTES.

Austrian Succession States.—Telegraph and Telephone Agreement.—At its plenary sitting on November 17th, the Porto Rosa Conference definitely approved the text of the agreements between the Austrian Succession States in the matter of postal, telegraph, and telephone services, and the agreements will be signed in the course of a few days. The telegraph and telephone agreement provides for the re-establishment of several telegraph and telephone lines between the Succession States. A number of clauses deal with the payment of telegraph dues between the various administrations.—*Reuter's Trade Service* (Porto Rosa).

Costa Rica.—New Cable.—A contract entered into between the Government of Costa Rica and the "All America Cables Incorporated Co." for the establishment, within a period of 18 months, of a direct cable service between Costa Rica and foreign countries, was finally approved on October 9th. The direct cable service, it is understood, will connect Port Limon with the company's cables serving the Isthmus of Panama. A translation of the contract from the *Costa Rica Official Gazette* can be seen at the Department of Overseas Trade, says the *Financial News*.

Germany.—Telegraph Charges.—Owing to the depreciation in the mark, the rates for telegrams to foreign countries from Germany were to be increased by 170 per cent. as from November 20th.—*Reuter's Trade Service* (Berlin).

Imperial Wireless.—The Postmaster-General announces that the statement which appeared in a daily paper to the effect that the scheme for the Imperial Wireless Chain had collapsed is devoid of foundation. This scheme was approved by the Government, and was endorsed by a Committee of the Imperial Conference over which Mr. Churchill presided, and by the Conference itself.

The scheme was accepted by the Prime Minister of the Commonwealth subject to giving full freedom of action to Australia to decide the method in which she would co-operate. No change in the policy of the Government has since taken place. The first two stations in the Imperial Chain—those at Leafield and Cairo—will be working by the end of this year, and the report of a Commission of experts which has been engaged in designing the remaining stations is expected within a few weeks. On its receipt the construction of the stations will be proceeded with as quickly as possible.

Italy.—Telephone and Telegraph Extensions.—The Italian Parliament has sanctioned an outlay of 150,000,000 lire for urgent works and purchases needed for the systematisation of the urban and inter-urban telephone system and the telegraph network. This sum is to be disbursed as follows: 25,000,000 lire in the financial year 1921-22; 50,000,000 lire in 1922-23; 50,000,000 lire in 1923-24; and 25,000,000 lire in 1924-25. The choice of firms to undertake the several works and furnish the supplies will be made by the Government with the co-operation of the Minister of Posts and Telegraphs, the Public Works Department, and the Council of State. The granting of a concession to a national company for the installation and working of a submarine cable for direct communication with Spain, Brazil, Argentina and Greece is likewise authorised. A Government subsidy for ten years will be contingent upon the realisation of a minimum of words exchanged by each cable. Other help afforded is in the shape of relief from certain taxes to the extent of 6 per cent. of the paid-up capital of the several companies.

A decree dated August 20th sanctions the outlay of 16,000,000 lire for the installation of telegraph and telephone lines along the course of the sections of railway now being electrified, namely, Turin-Susa, Turin-Chieri, Turin-Ronco, and the approaches to Voghera. The disbursements will

be made in two equal amounts in the financial years 1921-2 and 1922-3 through the medium of the Deposits and Loans Fund, which is duly authorised to make the advances.

The Telegraph Service.—Rate Reduction.—The Postmaster-General announces that the telegraph rate of 5½d. a word has been reduced to 4½d. for Esthonia, 4d. for Latvia, and 3½d. for Lithuania. The rate to Russia is 5½d. a word, both by the Government-owned Anglo-Russian cable and by the Great Northern telegraph routes *via* Finland and *via* Latvia. Telegrams for Russia by any route are still only accepted at the sender's risk.

The Telephone Service.—Speaking at Bedford on November 10th, the Postmaster-General said the extensive programme for laying telegraph and telephone cables underground was employing a considerable amount of skilled and unskilled labour in different parts of the country. It was not relief work, as it was generally understood, but it had the great advantage of being revenue earning and of reducing the expenditure of the Post Office on maintenance and repairs.

The Post Office was also putting in hand a large number of new telephone exchanges and extensions to existing exchanges. During the next six months 23 new exchanges would be completed and 47 existing exchanges extended. During the year ended October 31st, 26 new exchanges had been completed and extensions had been made to 15 exchanges. The total number of stations in use at the end of September was 964,479, or an increase of 3,447 over the total at the end of August. New orders were coming in at a satisfactory rate, and the number of people giving up the telephone was slightly below the normal. They were fast overtaking arrears of work, and the telephone traffic showed a slight tendency to improve, especially in London, where the average calling rate had shown a steady increase each week since the end of August up to and including the last week in October.

These facts, he thought, were evidence of a revival in trade. Telephone traffic was peculiarly susceptible to trade conditions, and the fact that telephone traffic showed an increase was an encouraging sign.—*The Times.*

Sheffield's New Exchange.—A start was made on November 21st on Sheffield's new telephone exchange, which is to be erected in Bow Street, in the centre of the city. It is estimated that it will take four years to build the exchange. Coinciding with the installation of the new exchange the postal authorities are laying underground telephone wires.—*Daily Telegraph.*

Wireless Telegraphy.—Stations Closed.—The wireless stations on the aerodromes at Castle Bromwich (Birmingham) and Didsbury (Manchester), the Air Ministry says, will from November 16th until further notice be temporarily closed for traffic, and the meteorological reports hitherto transmitted to the Air Ministry by them will be discontinued.

Vinga Station.—The radio service at Vinga station will begin on November 22nd to give bearings to ships on demand for the purpose of facilitating entrance into Gothenburg harbour and passing Skagen Point. The range of the radio station is over 100 nautical miles.—*Reuter's Trade Service* (Stockholm).

Wireless Telephony.—The wireless telephone on the Bar Lightship, which was licensed by the Post Office early this year for communication with the Mersey Docks and Harbour Board at Liverpool, is now equipped with the new Marconi ringing-up device, which dispenses with the necessity for a continuous watch. The utility of this addition was clearly demonstrated last week, when a tug equipped with wireless despatched an urgent telegraphic message which the Bar Lightship received and comunicated to the Harbour Board. The telephonic mesage reached Liverpool some time before that received through telegraphic channels.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 4th. Victorian Government Railways. One set pyrometer equipment (cont. 34,705), electrical equipment for cargo shifter (cont. 34,723), electric rivet heater and accessories (cont. 34,735).*

Five electric road trucks.—*Reuter's Trade Service* (Melbourne).

January 25th. Ten coasting recorders or, alternatively, 10 coasting and service recorders for the trains (cont. 34,736).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (schedule 1,718 and 604). (November 18th.)

February 22nd. N.S.W. Government Railways and Tramways Department. One 5,000-kW, 50-cycle turbo-alternator, with condenser and accessories, for the Newcastle power house.*

Brisbane.—February 10th. City Electric Light Co., Ltd. Six miles of 3-core, 0.15 sq. in., paper-insulated cable.*

Bulgaria.—January 10th. Direction of Posts and Telephones. Sixty 50-line telephone exchanges, fifteen 100-line ditto. (November 11th.)

Chorley.—November 30th. Board of Guardians. Storage battery (128 cells—capacity 300 Ah) and booster for the Institution, Eaves Lane. (November 18th.)

Dublin.—December 12th. Dublin United Tramways Co. (1896), Ltd. General stores, including electric supplies for six months. (See this issue.)

Egypt.—Alexandria.—December 21st. Port and Lighthouse Administration. Stores, including electric lamps, for six months.*

Farnworth.—December 7th. Urban District Council Electricity Department. L.p. cables, distribution pillars, transformer, h.p. and l.p. switches. (See this issue.)

France.—December 6th. Sarre Postal Authorities. 43 tons of copper cable, 3, 4 and 5 mm. dia., and 16 tons of bronze cable, 1, 2 and 5 mm. dia. Particulars from La Direction Superieure des Postes, Sarrebruck.

Glasgow.—November 28th. Health Department. Works (including electric lighting) in connection with the erection of doctors' and workmen's houses at Robroyston Hospital. Office of Public Works, 64, Cochrane Street, Glasgow.

November 30th. Gas Department. Two electric locomotives to haul 30 tons. (November 11th.)

Italy.—December 15th. Italian State Railway Authorities, Rome (14, Via Le Policlinico). Electrification of the Bologna-Milan line.

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (November 18th.)

London.—Fulham.—November 29th. Electricity Supply Department. 11,000 yards .2 sq. in. h.p. (3,000 V) concentric paper-insulated lead-covered cable. (November 18th.)

Manchester. — December 2nd. Electricity Committee. Hand-operated overhead travelling cranes. Barton power station, Oldham Road, and Stuart Street sub-stations. (November 18th.)

December 9th. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station. (November 18th.)

New Zealand.—Wellington.—January 31st. Public Works Tender Board. Two sets 3-phase, 6,600-V automatic oil circuit breakers, four sets disconnector switches, and one 66,000-V air-break, lever-operated switch for main transformer switches, for Lake Coleridge power house.*

March 6th. Public Works Tender Board. Waikato power scheme. Two 2,500-kVA alternators, two 3,100-h.p. water turbines, two exciter sets.*

Shipley.—November 28th. Education Department. Electric light and power installation at the Technical School. Director of Education, Education Office, Saltaire Road.

Spain.—November 30th. The *Diario Oficial del Ministerio de la Guerra* publishes the basis of a competition for the supply of wireless material for the 1st Regiment of Telegraphists and Wireless Battalion, and for the choice of models of regulation stations. The date of opening the tenders is November 30th.

Warrington.—November 28th. Electricity and Tramways Committee. Sub-station ironclad switchgear, high and medium pressure lead-covered cables. (November 18th.)

Wexford.—December 8th. Corporation. Overhead l.p. distribution mains, street lanterns, &c. (November 11th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia. — Melbourne. — Victorian Electricity Commissioners. (Accepted):—

Complete steam-raising plant at the Morwell power-house (£282,000).—J. Thompson, Wolverhampton; £137,000 to be expended locally.

Supply of steelwork for ditto (£115,000).—Redpath, Brown & Co.—*Reuter's Trade Service* (Melbourne).

Birmingham.—The Scholey Construction Co., Ltd., has received a contract from the Corporation Tramways Department to carry out the Lincoln process of welding the fishplates to the rails at the joints.

Government Contracts.—The following Government contracts were placed during October, 1921:—

Admiralty Contract and Purchase Department.

Battery boxes.—Lawson & Co.
Cells.—General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric light installation.—G. E. Taylor & Co., Ltd.
Electric forging cranes.—Sir W. Arrol & Co., Ltd.
Electric lifts.—Wadsworth & Son.
Electrodes.—Quasi-Arc Co., Ltd.
Sheet mica.—R. & S. Baxter & Co., Ltd.
Valves for wireless telegraphy.—General Electric Co., Ltd.

War Office.

Electric carbons.—General Electric Co., Ltd.
Electric lamps.—English Electric & Siemens Supplies, Ltd.
Valves for wireless telegraphy.—A. C. Cossor, Ltd.; General Electric Co., Ltd.

AIR MINISTRY.

Boosters.— Scott & Co.
Electric storage battery.—Pritchett & Gold & E.P.S., Ltd.
Fire pumps.—Rees Roturbo Manufacturing Co., Ltd.
Ignition generators.—Delco Remy, Ltd.
Erection of wireless masts.—Coubro & Scrutton, Ltd.

POST OFFICE.

Electric lighting.—N.-W. District P.O. extension: G. E. Taylor & Co.
Laying conduits.—Keswick: J. F. Hodge & Co. Liverpool (North): J. F. Hodge & Co. Camberwell, Southwark, &c.: A. Thomson & Co. Shirland Mews, W.: A. Thomson & Co. Westminster, Chelsea and Holborn: A. Thomson & Co. Fulham, &c.: A. Thomson & Co. Hammersmith: A. Thomson & Co. Walsall-Wilienhall-Wolverhampton: A. R. Cleghorn. Birmingham-Coventry-Leamington (Section I): A. R. Cleghorn. Merthyr: Taplin & Holland, Ltd. Birmingham-Bilston: Taplin & Holland, Ltd. Stechford: Taplin & Holland, Ltd. Walsall-Wednesbury-Darlaston: Taplin & Holland, Ltd. Wednesbury-Darlaston: Taplin & Holland, Ltd. Birmingham area: Taplin & Holland, Ltd. Carmarthen and Penarth: Taplin & Holland, Ltd. London-Dorking (Section IV): Roads & Public Works, Ltd. Peckham Park Road: Roads & Public Works, Ltd. Willaston: G. P. Trentham, Ltd. Newcastle-Durham (Sections I and II): G. P. Trentham, Ltd. High Wycombe: G. P. Trentham, Ltd. Leicester: G. P. Trentham, Ltd. Dunfermline: G. P. Trentham, Ltd. Hagley: Martin & Element, Ltd. Birmingham-Halesowen Junction: Martin & Element, Ltd. Stamford Hill (Manor Road): H. Farrow. Wealdstone: J. Mowlem and Co., Ltd. Fleet: J. Mowlem & Co., Ltd. Beckenham (Kingshall Road): J. Mowlem & Co., Ltd. Willesden, Wembley, &c.: O. C. Summers. Hornsey, Islington, &c.: O. C. Summers. Whitstable and Westgate-on-Sea: O. C. Summers. Kettering: O. C. Summers. Oldham-Huddersfield (Section 1): E. E. Jeavons & Co., Ltd. Newcastle-Durham-West Hartlepool (Sections IV and V): W. Dobson. Ellesmere Port: E. Jowett. Birmingham-Coventry-Leamington (Sections II and III): J. A. Ewart, Ltd. Shooters Hill, S.E.: J. A. Ewart, Ltd. Preston-Blackburn-Burnley (Section II): J. A. Ewart, Ltd. Newington Causeway: J. A. Ewart, Ltd. Hatfield: J. A. Ewart, Ltd. London-Romford-Hornchurch-Brentwood: J. A. Ewart, Ltd. Chapeltown (Leeds): Whittaker, Ellis, Ltd. Roundhay: Whittaker, Ellis, Ltd. Irvine: Brookfield Construction Co. Gateshead: W. Irvin & Co., Ltd. Chichester and Horley: Hardy & Co.
L.p. switchgear and connections.—Liverpool H.P.O. Sub-station: Johnson and Phillips, Ltd.
Manufacture, supply, drawing-in, and jointing cable.—Birmingham-Worcester: British Insulated & Helsby Cables, Ltd. Glasgow-Edinburgh: Johnson & Phillips, Ltd.
Motor generators.—Liverpool H.P.O. Sub-station: British Thomson-Houston Co., Ltd.
Telephone exchange equipment.—Hull: Peel-Conner Telephone Works, Ltd. Birmingham (Victoria): Western Electric Co., Ltd. Bournemouth: Western Electric Co., Ltd. St. Albans: Western Electric Co., Ltd. Sub-contractors: Chloride Electric Storage Co., Ltd., for batteries. Romford: The British L.M. Ericsson Manufacturing Co., Ltd.
Transformers.—Liverpool H.P.O. Sub-station: Metropolitan-Vickers Electrical Co., Ltd.

POST OFFICE STORES DEPARTMENT.

Testing, protective apparatus, &c.—E. Turner.
Telephone apparatus.—Phœnix Telephone & Electric Works, Ltd.; Sterling Telephone & Electric Co., Ltd.
Telegraph and telephone cable.—Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Switchboard plugs.—E. Turner.

CROWN AGENTS FOR THE COLONIES.

Cable, &c.—W. T. Henley's Telegraph Works, Co., Ltd.
Copper wire.—F. Smith & Co.
Insulators.—Taylor, Tunnicliffe & Co., Ltd.
Switchboards.—Gent & Co., Ltd.
Switchboards, &c.—Western Electric Co., Ltd.
Telegraph material.—Siemens Bros. & Co., Ltd.
Telegraph instruments.—Tyer & Co.
Telephone materials.—British L.M. Ericsson Manufacturing Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.
Tramway materials.—R. Hudson, Ltd.

HIGH COMMISSIONER FOR INDIA.

Motor alternator.—Lancashire Dynamo & Motor Co., Ltd.
Baudot apparatus.—Elliott Bros. (London), Ltd.
Cable.—General Electric Co., Ltd.
Milking booster sets.—Crompton & Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.
X-ray tubes.—British Thomson-Houston Co., Ltd.; Newton & Wright, Ltd.

H.M. OFFICE OF WORKS

Engineering services.—Acton: Electric wiring.—Alpha Manufacturing Co.

London.—L.C.C. Highways Committee. (Accepted):—
Central car repair depôt; completion of superstructure (£91,574).—P. & W. Anderson, Ltd.

STEPNEY.—Electricity Supply Committee.
50 tons moulded pitch (£211).— J. Smart & Son. (Accepted.)
Eight street feeder pillars (£199).—W. Lucy & Co., Ltd. (Recommended.)
Feed-water heater for the new air ejector on No. 6 turbine (£169).—Worthington-Simpson, Ltd. (Accepted.)

FORTHCOMING EVENTS.

Electrical Power Engineers' Association (Southern Division).—Friday, November 25th. At 7 p.m. At the Central Hall, Westminster, S.W. Lecture on "Some Notes on Boiler House Plant," by Mr. A. W. Bennis.

Physical Society of London.—Friday, November 25th. At the Imperial College of Science, South Kensington, S.W. From 5-7 p.m. Discussion on "Hygrometry," to be opened by Sir N. Shaw, F.R.S.

Junior Institution of Engineers.—Friday, November 25th. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Electro-magnetic Instruments—Problems in Design and Construction," by Mr. G. F. Shotter.
Friday, December 2nd. Lecturette, "Notes on Maintenance of Electrical Accumulators," by Mr. B. L. Ladkin.

Institution of Production Engineers.—Friday, November 25th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 7.30 p.m. Paper on "Drawings and Production," by Mr. A. F. Guyler.

Liverpool Engineering Society.—Wednesday, November 30th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Modern Conceptions of Corrosion," by Mr. W. Ramsay.

Chemical Society.—Thursday, December 1st. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary scientific meeting.

Manchester Wireless Society.—Thursday, December 1st. At the Albion Hotel, Piccadilly. At 8 p.m. Paper on "High Frequency Amplification," by Mr. B. L. Stephenson.

Salford Technical and Engineering Association.—Saturday, December 3rd. At the Royal Technical College. At 7 p.m. Annual meeting.

Institution of Electrical Engineers.—Thursday, December 1st. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Cyc-Arc Process of Automatic Electric Welding," by Mr. L. J. Steele and Mr. H. Martin. Informal Dinner at the Engineers' Club.
Friday, December 2nd. At 5 p.m. Special general meeting.

(North Midland Centre).—Tuesday, November 29th. At the Hotel Metropole, Leeds. At 7 p.m. Ordinary meeting.

(North-Eastern Centre).—Monday, November 28th. At the Armstrong College, Newcastle. At 7.15 p.m. Paper on "Single and 3-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith.

(North-Western Centre).—Tuesday, November 29th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Induction Type Synchronous Motors," by Mr. L. H. A. Carr.

(London Students' Section).—Friday, December 2nd. At the Institution, Victoria Embankment. At 7 p.m. Paper on "Automatic and Semi-automatic Railway Signalling," by Mr. H. S. Petch.

Chelmsford Engineering Society.—Thursday, December 1st. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Small Public Electric Supply Undertakings," by Mr. J. N. Houblon.

Institute of Marine Engineers.—Friday, December 2nd. At the Hotel Cecil. At 7 p.m. Annual dinner

NOTES.

Ships' Electrical Auxiliaries.—Sir Owen Philipps, M.P., chairman of Elder, Dempster & Co., Ltd., on November 14th, received on board the vessel at Liverpool guests invited to inspect the *Aba*, a new Belfast-built ship intended for the company's service between British, Continental, and African ports. The vessel is a motor-ship. Her twin propellers are driven by Diesel oil engines. All the engine-room auxiliaries are driven by independent electric motors, with the exception of a small emergency steam-driven air compressor. Deck machinery and the steering-gear also are electrically driven. The *Aba* is 450 feet long and of a gross register of about 8,000 tons.—*Westminster Gazette.*

German Professor of Kinematography.—A chair has been established in the Berlin Technical High School for kinematograph technology, and Prof. Karl Forch is to be the first professor; he will lecture twice weekly.

Cheap Supply and Good Lighting.—Speaking recently at the Dublin Rotary Club, Mr. Ernest C. Handcock, M.I.C.E., said that electricity was not so expensive as was commonly believed, and demonstrated that, at the Dublin rate, a 5 lb. joint of beef could be cooked in an electric oven for 2d., while a 6 lb. joint lost but one ounce in electric cooking, against 25 to 30 per cent. by other methods. In Dublin he claimed that they had some of the best lighting of shops by electricity in the whole of the United Kingdom. The lighting in some spots, as in Grafton Street, was superior to that of London. He regretted that many unqualified men undertook electrical contracts, but rejoiced that now, as the result of the charter granted to the Institution, only chartered electrical engineers would be recognised as qualified and competent.

Finsbury Technical College Old Students' Association Dinner.—On November 12th over 80 members of the Old Students' Association sat down to the tenth annual dinner, which was held at the Engineers' Club, under the presidency of Dr. G. T. Morgan, Professor of Chemistry at Birmingham University. He was supported by a number of Past Presidents, including Messrs. Tennant and Raworth, Dr. Forster, and Capt. Wallis-Jones; and amongst the guests were Professors Donnan, Eccles, Hale, Philpot, and Mr. Sebastian. After "The King." Prof. Donnan proposed "The College" in a humorous speech which appealed to all present. His statement that Finsbury had proved its system of making students search for information in text books and laboratories to be correct by the very large number of its old students holding high positions in every part of the globe, was received with cheers.

Prof. Eccles, the present Dean of the College, in his reply said that, thanks to the generosity of the L.C.C. and others who had worked for the good cause, his speech this year need not be likened to a funeral oration, such as that of last year.

In proposing the Old Students' Association, Dr. Forster explained that the authorities were giving for fourpence an education which cost ninepence, and gave some figures to show the real generosity of the City and Guilds, which established the College in 1878. This statement was applauded by all present, and in conclusion he wished the Association continued strength and prosperity.

Dr. Morgan, in reply, acknowledged how much the City and Guilds had done, and remarked how pleased all must feel that Mr. L. B. Sebastian, the Chairman of the College Delegacy, was present as their guest.

Finally Mr. W. G. Head proposed "The Guests," and Prof. Philpot's reply was brief and to the point, but extremely optimistic on the future of Finsbury.

A musical programme (under the direction of Mr. Clark) was interspersed between speeches.

A smoking concert has been arranged for January 27th, to be held at the Engineers' Club, where, on the occasion of the dinner, the catering, service, and accommodation were all that could be desired.

An Electrical Suction Dredger.—A 20-in. suction dredger in use on the Sumas River in Washington was recently converted from steam to electrical operation by the Marsh Construction Co. As now arranged the dredger has a total connected load of 1,322.5 h.p. with motors ranging up to 1,000 h.p. Power is used at both 2,300 and 440 V, a cable and reel maintaining connection with the shore as the vessel moves forward. Power is taken from the 34,000-V transmission line that parallels the line of operation of the dredger, leads running from it to a bank of three 500 kVA transformers mounted on a scow moored to the bank of the river. This scow and the dredger are connected by a 1,000 ft. length of submarine cable carried by a reel mounted on a small scow lashed to the dredger. This cable is paid out automatically as the dredger moves ahead until all the cable has been reeled out. The transformer scow is then cast adrift and moved ahead, the slack in the submarine cable is coiled up on the reel, and a new connection is made between the transmission line and the transformer bank in its new position. The two largest power units on the dredger are the 1,000 h.p. motor that drives the main pump at the rate of 300 r.p.m., and the 150 h.p. motor that operates the cutter through a set of reduction gears. After the dredger had been in operation for a few weeks material was being handled at the rate of approximately 600 cubic yards an hour at a cost for power of from 1 to 1¼ cents per yard. Under normal operating conditions the dredger requires from 900 to 1,000 kW.—*Times Engineering Supplement.*

A Silent Electrical Tribute.—During the funeral of Lady Beck in Toronto, Canada, all the electric power supplied by the Ontario Hydro-Electric Commission, with which Sir Adam Beck has been associated since its inception in 1907, was cut off for one minute in 275 municipalities, over an area nearly as large as that of England.—*The Times.*

Fog and its Dispersion.—The difficulties attendant on the use of aerodromes by aeroplanes when a fog enshrouds the ground, are amongst the most troublesome of those with which aviation in this country has to deal. The possible means of dispersing fog, form the subject of a report, No. 727 (M.N.2), April, 1921, by the Aeronautical Research Committee, and may be summarised under three heads: (1) electrical, by subjecting the air of the aerodrome to a very strong electric field, or, if possible, a brush discharge. The theory of the method is discussed in an appendix (R.A.E. Report No. H. 550, presented by the director of research). An electrical discharge from a point does not spread over any appreciable volume of air, and the free paths of the normal small fog particles are very great in comparison with their size, so that electrical methods do not at present give much hope for a solution of the problem. All methods for discharging large quantities of electricity into the atmosphere fail largely on account of the small volume of air affected, and the committee has no reason to suppose that an experiment on the very large scale necessary for clearing an aerodrome would succeed if one on a smaller scale were not sure of success. (2) Mechanical, by propelling fog-free air downwards from above, or, alternatively, drawing it downwards by suction from beneath. This aspect of the problem is dealt with by the director of the Meteorological Office in a second appendix, and he concludes that "the dissipation of fog by such means is entirely outside the range of possibility." (3) Thermal, by artificially warming the air of the aerodrome sufficiently to evaporate the fog which drifts over it. Sir Napier Shaw's remarks on the latter method are as follows: "The problem is about the same as trying to raise by a few degrees the temperature of the top two inches of the Thames between the Lot's Road power station and Battersea Bridge when the tide has begun to ebb. . . . . I do not know how much coal they burn in an hour at Lot's Road, but if the experiment is to be tried it had better be on a small brook first."

International Conference of Electrical Engineers.—An International Conference of Electrical Engineers was opened in Paris on November 21st, under the auspices of the International Electro-technical Commission. The conference was presided over by M. Le Trocquer, Minister of Public Works, and was attended by forty delegates from twelve countries; the British delegates included Messrs. P. V. Hunter, E. B. Wedmore, and W. B. Woodhouse. Canada is among the nations sending delegates. The object of the conference is to study the construction and standardisation of equipment for the interconnection of high-power transmission stations. Thursday's sitting was to be held at the Sorbonne, and was to be presided over by M. Millerand, the President of the Republic.—*Reuter's Trade Service* (Paris).

The Electrical Gasification of Coal.—Mr. Edwin, of the A.S. Norsk Staal, has presented a report before the Norwegian Association of Engineers, concerning his experiments in the direction of the electrical gasification of coal. He is reported to have stated that he had solved this problem, that his method would permit of the coal consumption at an ironworks being reduced to 14 to 15 per cent. of what is reckoned with blast furnace working, and that the gas could be transmitted over long distances equally as cheap as electrical energy.

Educational.—Wireless Classes.—"Wireless" classes are now being held every Tuesday and Thursday evening at the premises of Messrs. Cunningham, Ltd., 169-171, Edgware Road, W.2. The fee is 1s. 6d. per lesson, and is under the direction of their expert Mr. C. J. Close, late of the Government service and Marconi's. Further particulars can be had on application to the firm.

Electric Ship Propulsion.—The steamship *San Benito*, the largest electrically-propelled cargo ship built and equipped outside the U.S.A., docked on October 24th in America, says the *Journal of Commerce & Commercial Bulletin*, after a stormy but successful voyage from Almeria, Spain. For twenty-four consecutive hours she was in a cyclone, the worst weather Captain J. C. Jackson said he had experienced in his twenty-nine years at sea, but she reached port in perfect condition, so far as her equipment was concerned.

"Ordinarily under such conditions we would have had all sorts of trouble with our propeller racing, but with this electric drive we did not experience any such trouble," said Captain Jackson. "I have never been on a ship that acted so well under all conditions, there was not the slightest evidence of any racing. Another feature which impressed me, was the absence of vibration. Truly, this is the finest ship I have been on in my many years at sea." Chief Engineer B. Crumley was just as enthusiastic.

Among the twenty-eight passengers on the *San Benito* were Mr. McClelland, director of electrical engineering, of the British Admiralty, and his deputy, Mr. S. D. Constable. Both were elated at the success of the trip. "Never saw anything more reliable in my life than this electric drive," said Mr. McClelland, "and in my report to the Admiralty I certainly shall praise this type of propulsion."

The *San Benito* is a new ship, and this was her maiden voyage. She was built by Workman, Clark & Co., of Belfast, for the United Fruit Line, as announced in our pages recently. She has a tonnage of 5,500, is 336 feet long, has a beam of 45 feet, and was designed for a speed of 12.5 knots. Her electrical equipment, built and installed by the British Thomson-Houston Co., Ltd., consists of a 2,040-kilowatt Curtis turbo-generator, driving a 3,000-horse-power synchronous motor in the stern of the ship attached to the propeller. This feature eliminates the shaft alley and shafting and adds considerably to its cargo space.

Her circulating pumps, forced air draught and ventilating systems are also electrically operated. On her trip she maintained an average speed of 10.5 knots, considered remarkably good for the weather encountered, and made a maximum speed of 15.1 knots. She left the shipyards at Belfast, September 28th, and cleared Almeria with a cargo of onions and grapes on October 10th. After a week in New York, she will be sent to Boston, where she will be placed in service between that port and Central America, in conjunction with her three sister ships, the steamers *San Blas*, *San Gill*, and *San Bruno*, all of which are equipped with reciprocating engine drive.

Selenium Substitute.—The crystal found in Japan and Borneo, and known as antimonite, is said to hold out hopes of being used as a substitute for selenium. The great drawback to the use of the latter is its fatigue, but antimonite can be produced synthetically and is reported to be capable of responding to variations in light with wonderful rapidity.

Transmission of X-rays.—A remarkable property of X-rays, in virtue of which they can be conducted like an electric current through a metallic tape, has, it is claimed, been discovered by Mr. Henry J. Monson, a radiographer and X-ray specialist.

"Hitherto we have had to place the patient quite near the X-rays tube with the risk of producing inflammation of the skin," said Mr. Monson to the *Daily Mail*. "By means of this simple appliance, the X-rays can be carried a long distance, even into another room, and applied to the patient without the danger of skin burning."

The apparatus consists of an insulated copper plate which is placed over the X-rays tube and is separated from it by a thickness of wood. Electrodes are attached to the plate, and from them the rays can be carried to the patient at a distance. According to the paper, the X-rays appear to accumulate in the copper plate, and from that they pass along the conductor much in the same way as electricity.

Effect of Lighting on Output.—In the course of a paper on the work of the Industrial Fatigue Research Board and its application to industry which Mr. D. R. Wilson, M.A., secretary to the Board, read before members of the Royal Society of Arts, in November, the author points out that the effects of lighting on production have been studied by Elton, in silk weaving, a fine process specially susceptible to variations in illumination, and presents a table showing the distribution of output (corrected for certain variables) from 56 looms during a week in December, 1919. The working day commenced at 7.30 a.m. and ended at 5.15 p.m.; the use of artificial light was confined to the first and last periods, and he remarks that to this must be attributed in a great part the heavy drop in output observed, since at a later season, when artificial lighting was no longer used, the reduction in output at the beginning and end of the period of employment, though still present, was much less marked. Elton concludes that under artificial illumination production falls, even if electric light of sufficient intensity is provided, and that the magnitude of the fall is of the order of 10 per cent. of the daylight value of the rate of output.

Appointments Vacant.—Engineer (£300+war bonus= £528), for H.M. Mining School, Portsmouth; plumber-jointer, for Nelson Corporation Electricity Works; assistant distribution engineer (£252), for the Woolwich Corporation Electricity Department; part-time lecturer in electrical engineering, for the Goldsmiths' College, New Cross, S.E.; plumber-jointer, for the Salford Corporation Electricity Department; junior engineer as electrical laboratory assistant (£85+war bonus= £195), for H.M. Mining School, Portsmouth; plumber-jointer, for the Walthamstow Urban District Council Electricity Department. (See our advertisement pages to-day.)

Tidal Power in Italy.—The movement to utilise the tides has now spread to Italy, where Signor Cattaneo, of Genoa, has just set up a plant. He had previously experimented with a small plant to light his dwelling at Voltri. A visit paid to the latter by the Minister of the Italian Marine has resulted, it is said, in a contract being signed with Signor Cattaneo for the construction of a first station of 500 h.p. capacity at the Arsenal of Spezia. An Italo-American syndicate, it is furthermore stated, has formed an Italian company with a capital of 50,000,000 lire to work an Italian patent for similar installations.

L.E.E. Anti-Aircraft Dinner.—On Saturday, November 12th, a re-union dinner took place at the Holborn Restaurant of members of the 7th Anti-Aircraft Searchlight Section, London Electrical Engineers. Owing to the energies of Mr. Collins the following were present: Messrs. F. Childs, E. Moore, R. Collins, H. Verey, G. Keen, E. Collings, E. McCarthy, R. Bonnett, J. Palmer, S. Smith, H. Thomas, and H. Payn, but it was not possible to obtain the addresses of several others, including two former commanding officers. Several toasts were proposed, and it was suggested that the dinner be made an annual affair. If this notice should catch the eyes of any members who were not present they are invited to send a note of their addresses to Mr. R. Collins, 43, Brick Street, Piccadilly, W.1.

Cancer Hospital's New X-ray Plant.—The latest addition to the X-ray and electro-therapeutic department of the Cancer Hospital is a twin induction coil installation of British manufacture, designed to give a pressure of from 250,000 to 300,000 volts. The apparatus will be used to test the value of the new technique for the treatment of deep-seated cancer, and a new apparatus for localising the radiation at any depth in the body will be used. The apparatus is the combined work of the staff at the Cancer Hospital, and one of the chief features of the theraputic room is the method employed for the protection of the operator.—*The Times.*

The Cost of Ventilating Tunnels.—Mr. Hutton, Inspector of Mines, Germiston, has made a comparison of the cost of ventilating a long tunnel by means of electric fan, compressed air fan, and compressed air direct. A typical case is taken; this is 2,000 ft. in length, with a cross section of 50 square feet, and the calculation is made for the whole of the ventilation from the commencement to the completion of the tunnel, a period of 25 months. The fan ventilation allows for capital cost of fans, of which two will be worn out if they are compressed air fans, for maintenance, cost of 16 in. piping, for power, or compressed air, and incidentals. Compressed air cost is taken at the prices charged by the Victoria Falls Power Co.—probably the lowest at which compressed air is obtainable on the Witwatersrand. The comparison is as follows:—

Method.	Total air. Cub. ft.	Total Cost.	Cost per 1,000 Cub. ft.
Electric fan	1,872,000,000	£638	0.082d.
Compressed air fan	1,053,000,000	£978	0.223d.
Compressed air direct ...	224,125,000	£1,077	1,154d.

It will be seen that although the amount of air which is supplied by fan ventilation is many times larger than with compressed air supplied direct, the cost is considerably less.—*S. A. Mining and Engineering Journal.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—East Midlands Sub-Centre.—The following meetings have been arranged:—December 13th, paper on "The Whirling of Shafts," by Prof. C. H. Bulleid; January 3rd, 1922, Address by Mr. R. A. Chattock; January 24th, paper on "The Loughborough Electricity Undertaking and Extensions in Hand," by Mr. R. B. Leach; February 14th, to be announced later; March 7th, paper on "The X-ray Examination of Materials," by Mr. J. F. Driver; March 28th, paper on "The Future Aspect of Power Generation," by Mr. A. Hugh Seabrook; April 18th, paper on "Electric Vehicles," by Mr. R. J. Mitchell; May 9th, Annual General Meeting.

North-Eastern Centre.—A series of joint meetings has been arranged between the Associates and Students of the Centre, the North of England Institute of Mining and Mechanical Engineers, and the North-East Coast Institution of Engineers and Shipbuilders. The first meeting was held on November 17th, when Professor Henry Louis, D.Sc., gave an address upon "The History of Iron and Steel Manufacture." Another meeting was held on November 19th, when a paper was read by Mr. John T. Pringle upon "The Installation of a Ward-Leonard Winding Plant at the Cowpen Coal Co.'s Isabella Colliery."

The Royal Charter.—On November 17th an extraordinary general meeting of the Instiution was held at which a resolution was passed authorising the voluntary liquidation of the Institution as a limited company, with Sir James Devonshire and Mr. P. F. Rowell as liquidators, this being a necessary formality in view of the Institution being granted a Royal Charter. A meeting will be held on December 2nd to confirm the resolution.

North-Western Centre.—*Liverpool Sub-Centre.*—Mr. E. S. Byng read his paper on "Telephone Line Work in the U.S.A." before the Sub-Centre on November 21st. Mr. Eames opened the discussion, and was followed by Messrs. Bolton, Pratt, Morton, Cowburn, Holthum, Brookes, Mercer and Adams. The discussion centred round a criticism of American practice as compared with English.

Informal Meeting.—On Monday last at an informal meeting held at the Institution building, Mr. J. F. Avila presiding, a discussion on "Hydro-electric Power" took place. Mr. A. J. Hainsworth opened the discussion with a brief account of a large installation in New Zealand, illustrated with diagrams.

An interesting discussion followed, in which many speakers took part. The attendance was very large, the whole of the seating accommodation being fully utilised.

Chelmsford Engineering Society.—On November 17th a paper was read by Mr. C. W. Boyle, A.M.I.C.E., on the "Poulsen Arc as applied to Wireless Telegraphy.' The President (Mr. G. F. Barrett) was in the chair. The design of the arc generator for high-frequency currents was gone into very thoroughly. The author said that the shape of the pole tips of the magnets was important; the gap between them was fixed by the power of the arc or size of the electrodes. The pole cores were round, and should be of diameter equal to approximately four times the length of the gap, and the best shape of pole tips was conical, with the tips cut off square, the angle of slope being 55 degs. to the face, and the face diameter approximately 0.433 of the diameter of the pole cores. This ensured a concentrated magnetic field in the gap. The efficiency of the arc was usually about 40 per cent., the theoretical maximum being 50 per cent.

National Union of Scientific Workers.—The annual general meeting was held in London on November 12th, when Professor Leonard Bairstow, F.R.S., the retiring president, delivered his address. Prof. Bairstow deplored the continued inadequacy of the rewards received by inventors and scientists, and stated that the "Geddes" Economy Committee clearly failed to realise the importance of the part played by the scientific worker. The negotiations for the amalgamation of the Union with the British Association of Chemists promised well, and brought them nearer the desired goal of proper recognition. Dr. A. A. Griffith was elected president for the ensuing year; Prof. J. Stanley Gardiner and Dr. Harold Jeffreys were appointed president and secretary respectively of the Research Council.

The annual dinner followed the meeting, Sir Frank Baines, H.M. Office of Works, being the principal guest.

The Optical Society.—A series of meetings has been arranged which will be devoted to subjects dealing with the evolution and development of various types of optical instruments. The first meeting was held at the Imperial College on November 24th. The subject was "Polarising Apparatus." Professor F. J. Cheshire, C.B.E., was to give a demonstration.

Nottingham Society of Engineers.—At a meeting held on November 23rd, Mr. A. D. Phillips, M.I.E.E., read a paper on "The Economics of Power Transmission and Distribution." The author compared the efficiencies of large and small stations, discussed the most economical voltages for certain applications, and also dealt with e.h.p. direct-current transmission.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. W. E. Burnand, the new chairman of the North-Midland Section of the Institution of Electrical Engineers, who delivered his inaugural address on November 15th, is in business as W. E. Burnand & Co. (electrical power engineers and wholesale dealers in electrical supplies) at Chippinghouse Works, Lowfields, Sheffield. He has no partner in the ordinary sense of the term, the word "company" in the firm's name really standing for the workmen. Mr. Burnand is justified in the cultivation of a spirit of comradeship between himself and his employés by a 25 years' record without labour troubles. He was born in 1875, and apprenticed to the Sheffield Telephone Exchange and Electric Light Co., Ltd., the predecessors of the present extensive municipal electricity supply undertak-

ing. He entered the Sheffield company's service—1892-1896 was the period of his apprenticeship—when the generating plant comprised 50-kW and 200-kW single-phase alternators and three Thomson-Houston arc lighters, and when three-fourths of the units generated came from the 50-kW machine For some time Burnand had charge of the plant, and having a good deal of time to spare for experimental work he profitably employed it in designing and experimenting with motors and transformers, in developing and patenting an arc lamp with

Ethel Eadon] [*Sheffield.*

MR. W. E. BURNAND,
Chairman of the North-Midland Centre of the Institution of Electrical Engineers.

inclined carbons, regulating mechanism, and with a reflector over the arc. Meter work also occupied his attention. In 1896 his desires for greater activity in such directions led him, in spite of the fact that he had little money at his command, to start in business on his own account in the manufacture of transformers and arc lamps. He started on a very small scale, but the one-man business has now grown to be a large one, with extensive works at Sheffield. The manufacture of arc lamps was abandoned and that of induction motors was taken up. In this branch of work steady progress has been made, and the motors are in use for all purposes, from driving a chaff cutter to running a steel rolling mill. Mr. Burnand in recent years has developed a "super" slide rule, chiefly for transformer calculations. He has designed many power plant lay-outs, also special machine tools, and has assisted in the development of special tools for the local trades, applying electrical methods that have converted apparent failures into commercially successful machines, and apart from appliances for the local trades, has designed transformers for wireless and welding and many non-standard motors for special work, in addition to the usual standard requirements which are in extensive use in the Navy and elsewhere.

Mr. J. N. ROBERTSON, Assistant Sub-Station Superintendent of the Glasgow Corporation Electricity Department, has accepted an appointment as an outside representative of The British Electric Transformer Co., Ltd., Hayes, Middlesex. Mr. Robertson has been associated with the power stations and sub-stations of the Glasgow Corporation for the past fourteen years. Shortly after his return from the army in 1919 (in which he held a commission) Mr. Robertson was appointed assistant sub-station superintendent. On the eve of his departure for London he was presented with an attaché case and a set of silver-mounted brushes from the staff and employés of the electricity department.

Mr. JAS. D. DOW, who was for many years the sales manager of the old Armorduct Manufacturing Co., Ltd., has now been appointed manager of the cable department of Magic Appliances, Ltd., who are supplying the H.B. (Armorduct) cables.

Mr. J. ROLAND GOTT, assistant under Mr. C. I. Baker, Blackpool Tramways Traffic Superintendent, leaves England next month to take up an appointment as general assistant to the traffic manager of Calcutta tramways.

Mr. JOHN HORNE is leaving the Metropolitan-Vickers Export Co. at the end of this month to take up an important position on the London staff of the A.C.E.C. (Ateliers de Constructions Electriques de Charleroi). Mr. Horne has been associated with the British Westinghouse and Metropolitan-Vickers companies for nearly 15 years.

On the occasion of the opening of the Blackburn Meadows Power Station by H.R.H. the Duke of York, on November 4th, a kinematograph record was taken, which was subsequently exhibited for a week in the Sheffield picture theatres. Thus, we understand, Mr. S. E. FEDDEN (City Electrical Engineer and Manager) made his *debût* as a film actor. It would be interesting to know whether any other central station engineer has anticipated Mr. Fedden in this respect.

According to the *Electrical News* (Canada), Mr. F. JOHN BELL recently resigned the position of president and general manager of the Canada Wire & Cable Co., Toronto. He has also resigned as president and general manager of Leaside Engineering Co., which corporation controls the cable company and other firms, including the Leaside Munitions Co.

Mr. W. HARTLEY, of the Rochdale Corporation Electricity Works, who has resigned his post of mains superintendent through ill-health, has been connected with the department for over 12 years.

Mr. H. GUY WOOD has resigned his position with the City of Birmingham Electric Supply Department, to take up an appointment with the Calcutta Electric Supply Corporation, Ltd. as station engineer. On leaving Birmingham he was presented with a silver cigarette case by the members of the generated staff. As lieutenant in the R.E. (T.), he was recently transferred from the 2nd N. Mid. Field Co., 46th Divisional Engineers, Corps of Royal Engineers (T.A.), to the Territorial Army Reserve.

Mr. CHAS. S. ATKINSON, A.M.I.E.E., for the past 17 years on the staff of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated company, the Cleveland & Durham Electric Power Co., has resigned his appointment to enter into partnership with Mr. P. Nutter (who was also for many years on the staff of the former company), in the business of Messrs. P. Nutter & Son, 41, Side, Newcastle-on-Tyne, engineers and merchants.

Mr. G. W. SOMERVILLE, A.M.I.E.E., has been appointed manager of the electrical department of Messrs. Joseph Walton & Son, of Nelson.

Prof. BRANLY, the inventor of the coherer, has refused a grant of £800 per annum by the French Chamber of Deputies, declaring that he is not worthy to rank with such men as Pasteur and Lamartine, to whom such grants were made.

Obituary.—MR. W. H. BOOTH.—The death of William Henry Booth has deprived the engineering world of one of its most original and daring thinkers, the technical Press of a much appreciated contributor, and the editors of the ELECTRICAL REVIEW of a highly esteemed friend, with whom they

Yeulett & Co.] [*London.*

THE LATE MR. W. H. BOOTH.

had had pleasant relationships during more than thirty years. Mr. Booth, who was a man of wide practical experience, left Lancashire (he was born at Rochdale and educated there and at Owens College, Manchester) in 1877 to seek advancement in New Zealand and Australia. After his return to England in 1880, he spent some years in boiler construction work and in technical journalism. In the latter sphere he was associated with the *Mechanical World* and the *Practical Engineer*; of the

last named he was one of the founders. He came to London in 1889 and was associated with others in promoting a Bill for a shallow electric railway across the West End of London, but the Bill was thrown out. Later he held an appointment with Le Grand & Sutcliffe, and subsequently entered into various engineering partnerships in London, carried out artesian well sinkings and public water supply undertakings, joined the engineering staff of the British Electric Traction Co., with whom he remained for several years, and in many other capacities enjoyed a very full life of engineering activity. To the pages of the ELECTRICAL REVIEW and other technical journals he was all through the period covered by these pursuits an ever-ready and profuse contributor possessed with original and critical ideas, able to express himself in the strongest language in condemnation of anything fallacious or fraudulent. He was deserving of greater credit than it was his lot to receive in various connections; for example, having a keen insight into the processes of combustion, he perceived the defects of the earlier types of water-tube boilers, and lost no opportunity of declaiming against the inadequate space allowed above the grate for the combustion of the hot gases, strenuously maintaining that these should never be permitted to come into contact with water-cooled surfaces until combustion was complete. These principles he propounded in numerous articles in our pages at the commencement of this century, and there is no doubt that his influence was largely effective in bringing about the reformed practice in this respect which is now regarded as standard. As a geological expert also he took high rank, particularly in connection with the provision of water supply to factories and townships. Mr. Booth frequently lectured on liquid fuel, smoke abatement, and other subjects, and he also wrote several well-known books. During the war he "did his bit" as an engineer in Government service in connection with the manufacture of gauges, and for a number of years at the Slough motor depôt in connection with the water supply, and we believe was the last official to leave, early in the present year. For some months past he had been in failing health, but he continued with his heart in his engineering work. He wrote his first article for the ELECTRICAL REVIEW (in conjunction with his old friend, Frank B. Lea, also a frequent writer to these pages) on the subject of "Steam Boilers" in September, 1891, and his last, by coincidence, appeared in the same issue in which it was our sad duty to announce his death. His spirit of daring and enterprise demonstrated itself in comparatively recent years when, a year or two before the war, he went on an exploring expedition to Venezuela, covering what was previously practically untrodden country, crossing swollen rivers by primitive means, and so forth, on behalf of certain City of London financial interests. He had been a member of the American Society of Civil Engineers since 1888, and a Fellow of the Geological Society. He was not a man to shrink from hardship, and he fought against many difficulties at various stages of his career. In the interest of engineering pursuits and in solicitude for the well-being of his family he never spared himself. He was a man of very determined resolution, of strong convictions, jealous for his personal liberty of thought; he was a roving unsettled man, not an unnatural or altogether undesirable disposition for a man of his profession, for the British engineer claims the whole world as his field of operations, and it is just as well. Latterly Mr. Booth had appeared to desire to settle down and be at rest. At the age of 67 years it has now been so ordained, for he passed away on November 12th at Worthing.

MR. W. R. KENNEDY.—The death is announced of Mr. W. R. Kennedy, a director of the Coleraine (Co. Derry) Foundry and inventor of the "Express" turbine and the "Challenge" turbine and water-wheel.

MR. W. MCHUGH.—The death has occurred after a very brief illness of Mr. Wm. McHugh, secretary of the Dublin United (Electric) Tramways Co. He had been 35 years in the service of the company, and was appointed secretary on the death of Mr. Tressilian, about six years ago.

MR. F. G. HART.—We regret to record the death of Mr. Francis George Hart, M.I.E.E., which occurred at Epping, suddenly, on November 21st, at the age of 63 years.

NEW COMPANIES REGISTERED.

Power House Components, Ltd. (177,881).—Private company. Registered November 17th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in, appliances, accessories, requisites, component parts, fittings and furnishings used in the engineering and motor, electrical, and kindred trades, &c. The provisional directors are:—W. P. Bow, 75, North Road, West Bridgford, clerk; F. W. Bee, "Ashlea," Edward Road, West Bridgford, Notts., articled clerk. Solicitor: C. Crowther, 23, Abingdon Street, Westminster.

Advance Lamp Co., Ltd. (177,868).—Private company. Registered November 17th. Capital, £1,000 in £1 shares. To carry on the business of designers, manufacturers, repairers, exporters, importers, buyers and sellers of, contractors for, and dealers in wire-filament, carbon-filament, and other electric lamps (including motor, portable, flash and other lamps), &c. The permanent directors are:—W. Sutton, 15, Prince's Way, Wallasey, Cheshire, electric supply dealer; H. W. Sutton, 23, Castle Road, Wallasey, Cheshire, electric supply dealer. Secretary: H. W. Sutton. Registered office: 10, Hockenhall Alley, Dale Street, Liverpool.

Delstar Engineering Co., Ltd. (177,810).—Private company. Registered November 14th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, motor manufacturers, manufacturers and sellers of electric and other motors, motor accessories, switchboards, transformers, generators, and all kinds of electrical gear and appliances, &c. The permanent directors are: H. Creighton, 46, Ella Street, Leeds; A. Blair, 12, Temple Crescent, Beeston Hill, Leeds. Qualification, 100 shares. Secretary: Emma Creighton. Registered office: 100, Woodhouse Street, Leeds.

R. F. Payne Gallwey & Co., Ltd. (177,802).—Private company. Registered November 12th. Capital, £100 in 1s. shares. To carry on the business of merchants, warehousemen, manufacturers' agents, manufacturers' importers and exporters, wholesale dealers in electric lamps, fittings and bells, bell installations and fittings, electric motors and switchgear, manufacturers of, and dealers in, tinware, copper, iron, brass and hardware goods of all kinds, mechanical, electrical and general engineers, merchants and factors for the supply to collieries and other manufacturing works of machinery and equipment, &c. The permanent directors are:—Sir John F. Payne Gallwey, Bart. (chairman), 7, Draycott Place, S.W. 1 (director of Sir J. F. Payne Gallwey, Brown & Co., Ltd.); R. F. Payne Gallwey (managing director), 11b, St. James's Square, Holland Park, W.; C. F. Sturdy (assistant managing director), 11b, St. James's Square, Holland Park, W. Qualification, five shares. Registered office: 58, Victoria Street, Westminster, S.W. 1.

Symondsbury Electric Lighting Co., Ltd. (177,885).—Private company. Registered November 17th. Capital, £2,000 in £5 shares. To provide electric light and power in Symondsbury, Bridport. The permanent directors are:—Rev. C. F. L. Sweet, The Rectory, Symondsbury; T. A. Walker, The Manor House, Symondsbury; E. J. Domville, Shutes, Symondsbury. The directors' borrowing powers are restricted to £100. Qualification of permanent directors, 100 shares. Secretary: E. J. Domville. Registered office: Symondsbury, Bridport, Dorset.

Carlton Lamp Co., Ltd. (177,827).—Private company. Registered November 15th. Capital, £500 in £1 shares. To carry on the business of manufacturers and vendors of electric lamps, fittings, and other appliances and apparatus for use in connection with electricity. The permanent directors are:—G. A. Sawyer, 58a, Pall Mall, S.W. 1, director; A. B. T. Roberts, 58a, Pall Mall, S.W. 1. Qualification, 50 shares. Remuneration, as fixed by the company. Registered office: 58a, Pall Mall, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kalgoorlie Electric Power & Lighting Corporation, Ltd. (91,219).—Return dated June 23rd, 1921. Capital, £225,000 in 175,000 preference shares of £1 each and 100,000 ordinary shares of 10s. each. 150,000 preference and 100,000 ordinary shares taken up. 10s. per share called up on seven ordinary. £3 10s. paid. £199,996 10s. considered as paid on 150,000 preference and 99,993 ordinary. Mortages and charges, £7,500.

Electric Supply Co. of Victoria, Ltd. (66,059).—Return dated October 27th, 1921. Capital, £325,000 in 175,000 preference and 140,000 ordinary shares of £1 each. 175,000 prefesence and 125,000 ordinary shares taken up. £50,007 paid. £249,993 considered as paid. Mortgages and charges, £109,713.

Direct West India Cable Co., Ltd. (53,956).—Return dated October 6th, 1921. Capital, £120,000 in £5 shares. 12,000 shares taken up; £60,000 paid. Mortgages and charges: Nil.

L. J. Healing & Co., Ltd. (97,137).—Return dated June 8th (filed October 7th, 1921). Capital, £100,000 in £10 shares (5,000 preferred, 5,000 deferred). 1,301 preferred and 5,000 deferred shares taken up; £13,010 paid; £50,000 considered as paid. Mortgages and charges: Nil.

British Electric Traction Co., Ltd. (49,855).—Return dated July 8th, 1921 (filed October 14th). Capital, £2,998,397 15s. £712,744 5s. 6 per cent. cum. pref. stock and £1,326,263 10s. ord. stock taken up, and paid for in full. Mortgages and charges: £1,733,133.

Hong Kong Tramway Co., Ltd.—Charge on certain lands, &c., dated May 30th, 1921, created outside the United Kingdom (supplemental to charge dated May 31st, 1919, securing $700,000). Holders: Hongkong & Shanghai Banking Corporation.

A. and A. Electrical Co., Ltd.—Satisfaction in full on September 18th, 1919, of charge dated November 5th, 1913, securing £250. (Notice filed November 15th, 1921.)

Splitdorf Electrical Co. of London, Ltd.—Satisfaction in full on August 29th, 1921, of debenture dated October 9th, 1919, securing £5,000.

C. F. Elwell, Ltd.—Mortgage debenture dated October 29th, 1921, to secure £3,000 charged on the company's property, present and future, including uncalled capital. Holders: Radio Communication Co., Ltd.

Lancashire Electric Light and Power Co., Ltd.—Trust deed dated October 20th, 1921 (supplemental to trust deed dated April 7th, 1911, securing £700,000 prior lien debenture stock). Charged on debenture stock and shares in Lancashire Power Co. and the company's undertaking and property, present and future, including uncalled capital. Trustees: N. Spens, 7, Union Court, E.C., and G. Collis, 2, Finch Lane, E.C.

Winscombe Electric Light and Power Co., Ltd.—Issue on November 9th, 1921, of £250 debentures, part of a series already registered.

Sevenoaks and District Electricity Co., Ltd.—Particulars of £15,000 debentures authorised October 14th, 1921. Present issue £100, charged on the company's undertaking and property, present and future, including uncalled capital.

Harris Electro Metal Co., Ltd.—Particulars of £2,000 debentures, authorised November 8th, 1921. Whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital.

CITY NOTES.

Eastern Telegraph Co., Ltd.

The report for 1920, which is to be submitted at the meeting on November 29th, states that the revenue was £4,381,856, less £1,629,057 for ordinary expenses, and £1,359,726 for maintenance of cables, income and war taxes payable abroad, share of contribution to pension and superannuation funds, towards depreciation of investments, payments to staff and other expenses incidental to the war, special grant on formation of staff widows' fund and sundry differences in exchange, leaving a balance of £1,398,072. After providing for income tax, corporation

profits tax, and E.P.D. payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £474,015, the balance is £919,058 plus £416,083 brought forward, making £1,335,140 available. £500,000 has been placed to general reserve, and £100,000 to Maintenance of Ships' Fund. The total distribution on the ordinary shares has been 10 per cent. free of income tax, and a dividend free of income tax has been paid on the new ordinary shares amounting to £18,662. There remains £316,479 to be carried forward. During the year £1,476,088 was expended in respect of new cables. In accordance with the purpose for which the new ordinary shares were issued £1,000,000 has been charged to capital expenditure, the balance of £476,088 being charged against general reserve fund. This fund has been debited with £301,022 for partial renewal of main line cables, £57,650 for loss on sale of investments, and £250,000 as a further provision on account of investment fluctuations. The balance to the credit of the fund is £2,217,930.

German Companies.

The *A.E.G.-Unternehmungen A.G.*, of Berlin, reports net profits of 641,000 marks for 1920-21, as compared with 652,000 marks, and the dividend is at the rate of 6 per cent., as in the previous year.

The directors of the *Telephonfabrik vorm. J. Berliner*, of Hanover, recommend a dividend at the rate of 20 per cent. for 1920-21, as compared with 15 per cent. in the previous year and an increase in the share capital from 20,000,000 to 40,000,000 marks.

The *A.G. fur Licht und Kraft*, of Munich, after making provision for depreciation, reports net profits of 1,591,000 marks for 1920-21, comparing with 452,000 marks in the previous year. A dividend at the rate of 10 per cent. has been declared, as against 8 per cent. in 1919-20. It was mentioned at the recent meeting that all departments were fully occupied.

The *Berlin Elevated and Underground Railway Co.* has decided to increase the share capital by 30,000,000 to 110,000,000 marks, so as to provide funds for new installations and extensions of working. An augmentation from 75,000,000 to 150,000,000 marks is proposed by the Berlin Electrical Undertakings Co. for meeting the requirements of associated concerns which are to carry out extensions of the generating stations, &c.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The directors have issued the accounts for the 11 months ended August 31st, 1921, to meet the requirements of Part I of the Second Schedule of the Finance Act, 1921. They show, after providing for doubtful debts and E.P.D. refund, a net loss of £445,461. The balance of profit brought forward from the previous year was £142,418. From this is deducted £11,458, the eleven-twelfths of dividend on preference shares, paid in January and July, leaving £130,960. To this is added £350,000 transferred from the reserve fund, making £480,960. Deducting from this the loss mentioned above (£445,461) there is to be carried forward £35,498. The report mentions that, of the net loss shown on the profit and loss account, a very large proportion is due to depreciation in the value of stock as at August 31st, 1921, compared with September 30th, 1920. The remainder of the loss is the result of the disastrous effects of the coal strike, the shorter hours of work, labour difficulties, the unsettled state of markets, and the great reduction of turnover due to the competition of dumped foreign goods and surplus stocks arising out of world-wide over production; these together have reduced the turnover by about one-half. To cover the loss on the eleven months' work the directors have withdrawn £350,000 (as mentioned) from the reserve fund, leaving £215,722 to the credit of that fund. The board regret that the payment of a dividend on the ordinary shares is impossible, but with a return to more normal conditions they feel confident that the company will once more be put on a dividend-paying basis. The warrants for the half-yearly dividend on the preference shares will be payable on January 2nd, 1922. Mons. H. E. P. Delajoux, manager of the company's works at Persan-Beaumont, has been appointed an extraordinary director. The meeting is to be held on November 30th at 106, Cannon Street, E.C.4.

Switzerland.—The balance sheet of the Société des Usines Electriques de la Lonza, of Basle, for the last financial year shows a loss of 3,200,000 francs, as contrasted with a profit of 185,672 francs in the preceding 12 months.

British Electric Traction Co., Ltd.—Interim dividend of 3 per cent. on the six per cent. cumulative participating preference stock.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Dividend of 2½ per cent., less tax, on preference shares for half-year ended July, 1908.—*Financial Times.*

The Ever-Ready Co. (Great Britain), Ltd.—Dividend at the rate of 7 per cent. per annum on preference shares for the half-year ended September 30th.

France.—The report of the Societe Pyrenéenne d'Energie Electrique, of Toulouse, for the last financial year shows a profit of 860,641 francs, as compared with only 548,685 francs in the preceding 12 months.

Prospectus.—*The British Thomson-Houston Co., Ltd.*—As briefly announced by us last week, this company has this week been offering for public subscription an issue of £1,500,000 seven per cent. mortgage debenture stock at 92½ per cent. The stock forms part of a total authorised issue of £5,000,000 stock, and will be repaid on or before May, 1962, by the operation of a cumulative sinking fund beginning next year. The redeemable price between 1931 and 1941 is 102½ per cent. or at par at any interest date thereafter if the company exercises its right to redeem at these dates. The unissued balance of £1,500,000 will be available for redemption of the 4½ per cent. first mortgage debenture stock, for payment of notes which fall due in 1925, or for the general purposes of the company. The prospectus contains a certificate by Messrs. Price, Waterhouse & Co., showing the profits for the last six years. The average of the last four years, after deducting reserves made for contingencies, amounted to £318,000, or about three times the annual amount required to provide interest and sinking fund on the present issue. The orders on hand at October 31st, 1921, were over £3,250,000. The objects of the present issue are to retire temporary loans and to provide for completion of extensions of the company's buildings and plant and further working capital.

The subscription list was closed on Monday afternoon. Country applications received the following morning by first post were considered.

The A.E.G. Dividend.—The directors of the A.E.G., after having set aside 100,000,000 marks as a first instalment towards the provision of a works' maintenance fund, report net profits amounting to 82,388,000 marks for 1920-21, as compared with 45,707,000 marks in the preceding year. The dividend proposed is at the rate of 16 per cent., as against 14 per cent. in 1919-20, and 10 per cent. in 1918-19. The shareholders will be asked at the forthcoming meeting to sanction a further increase of 250,000,000 marks in the ordinary share capital, to be issued at an appropriate time in the coming year.

Companies to be Struck off the Register.—The following are to be struck off the Register within three months, unless cause is shown to the contrary:—

Booth's Economisers, Ltd.
E. B. Magnetos, Ltd.
India Railless Traction Co., Ltd.
Kable Electrical Co., Ltd.
Technical News, Ltd.
Wallace Griffin Electrical Co., Ltd.
Accessories Manufacturing Co., Ltd. (registered November 7th, 1910).
Anglo-Colonial Engineering Co., Ltd.
Engineers' Standardised Publications Association, Ltd.
General Engineering Accessories, Ltd.

The French Cable Co.—The shareholders in the Compagnie Francaise des Câbles Télégraphiques have now sanctioned the proposed increase in the share capital from 16,000,000 to 24,000,000 fr., so as to permit of payment being made for the participation taken up in the Radio-Francaise. It is not expected that the emission will be offered for subscription before January at the earliest.

Callender's Share & Investment Trust, Ltd.—For the year ended August 31st the total revenue was £18,760, and after paying debenture interest, &c., £10,864 remains, plus £6,218 brought forward. £500 is put to reserve and £700 to corporation tax. A final dividend of 4 per cent., less tax, is recommended, making 8 per cent. for the year, and carrying forward £6,619.

New Issue.—According to *The Times*, public subscriptions will next week be invited for an issue of £400,000 7½ per cent. mortgage debenture stock of the Midland Counties Electric Supply Co. at 96.

Power Gas Corporation, Ltd.—Dividend at the rate of 6 per cent. per annum, less tax, for the year ended September.

STOCKS AND SHARES.

Tuesday Evening.

The two principal factors in the Stock Exchange markets at the present time are Ireland and naval disarmament. The first is certainly the more serious of the two. Possibly the City has taken a hyper-cautious view of the disarmament proposal, for there seems to be no great enthusiasm for the idea, except on the part of those who look some way ahead, and who regard the possible lightening of taxation as being more than compensation for whatever risks may be run by scaling-down the naval strength of the country. Armament shares are dullish, although showing recovery from the worst. The outstanding feature in the markets as a whole is the continued strength of the purely investment stocks.

Several tables which have been given here lately in connection with investment stocks and shares appear to have proved useful to readers who are on the look-out for suggestions, and to others who like to compare their own securities with what is offering in the markets. Accordingly, the following eight examples of what is obtainable, at the present time, may be of service as well as interest. This group is concerned with debenture stocks and debentures:—

Description.	Price.	Yield. Interest only.	Yield. Including redm.	Interest payable.	Redemption.
Anglo-Arg. Tram. 4% Deb.	62½	6 8 0	6 12 0	J. & J.	19'8 (by cum. sinking fund) at 102 or by purchase.
Calcutta Electric Supply 5% 1st Mort. Convert. Reg. Deb.	97½	5 2 6 net 7 6 0 gross	—	J. & J.	Tax free. Repayable by a cum. sinking fund of 5% by drawings at 102 or by purchase. Right to convert into ord. shares (£7 10s. deb. for £5 ord.) between June, 1922, & June, 1925, inclusive.
English Elec. 8% 6-year Secured Notes Reg.	96	8 7 0	9 11 0	J. & J.	1927 at 103% or after 1923 at 103%.
General Elec. Co. 7% Mort. Deb.	98½	7 1 6	7 2 0	M. & S.	1951 at par by annual drawings by means of a cum. sinking fund of 1%. Also after 1931 at par.
Lancashire Elec. Light and Power 7½% Prior Lien Deb. (issued at 95)	101¾	7 7 0	7 7 6	A. & O. (pat int. April)	1st, 1948 at 105 by means of a 2% cum. sinking fund. By drawings at 105 or by purchase.
Mersey Power Co. 7½% Mort. Deb. (issued at 97)	103	7 10 0	7 10 0	M. & S (£1 2 6 March)	1945 at 102 or earlier by means of an annual cum. sinking fund. Guaranteed as to both prin. and int. by the Salt Union, Ltd.
Newcastle-upon-Tyne Elec. Sup. 5% 2nd. Mort. Deb.	75 free	6 13 0	7 2 0	M. & S.	1949 at 110 or after 1912 at 102½.
Shropshire, Worc. and Staffs. Elec. Power 7½% 10-year guar. conv. Deb. (issued at 97).	99¾	7 10 0	7 10 0	J. & J. (part int. January)	1931 at par. Guaranteed as to both prin. and int. by the British Electric Traction Co., Ltd. Convertible at any time at the holders option into £1 0 of 8% "A" ord. shs. and £10 of "B" ord. shs. for each £100 stock.

The market for cable stocks and shares is inclined to sag. Eastern Extensions and Globes are down to 16¾, and Eastern Telegraph ordinary stock is not much better than 163. No change worth mentioning has occurred in Westerns, but the group as a whole has lost part of its usual buoyancy. Some people are asking whether this is due to the probable competition of wireless, having regard to the recent extension of the Radio Corporation's activities in the United States. Rumours, very vague and nebulous, are afloat concerning a remarkable development in connection with wireless telegraphy, said to be on the point of announcement from Germany.

Proprietors of cable stocks can afford to regard these factors with equanimity. Such considerations have played their part in depressing prices of the cable companies' stocks and shares in the past, but experience has hitherto proved that there is plenty of room, in the business world, for submarine as well as for overhead work. It is fair to assume that cable companies have suffered in the same way as most other industrial undertakings from the world-wide depression in trade, but the Stock Exchange, at any rate, entertains no apprehension as to the probability of dividends being reduced from the 10 per cent. at present paid on the ordinary stocks of the Eastern group. There is, of course, always the chance of companies which declare their dividends free of tax making such an alteration as would involve payment of the dividends less tax, though this, in the case of the cable concerns, is highly improbable.

The wireless shares are none too strong, the shares of the parent company being 1/16 easier at 3 1/3, the preference having shaded off to the same price. Radio Corporation common are 9s. 9d and the preferred 9s. 3d.

Electrical manufacturing shares are going quietly. There is not much change in the prices this week. Electric Constructions are unaffected by the declaration of an interim dividend at the rate of 6 per cent. Last year the dividend for the full 12 months was 10 per cent. General Electric "B" preference are better at 17s. 6d., while the ordinary remain steady at this same price. British Aluminiums have hardened to 14s. 6d. Edisons are threepence up at 5s. 3d., but the first debenture shed 2 points to 65, and the preference at 13s. 6d. are lower on the week.

The India-Rubber, Gutta-Percha and Telegraph Works Co., in its report for the eleven months to August 31st last, shows a net loss of £445,000. By transferring £350,000 from reserve and adding the amount brought in from last time, a credit balance of £35,000 is realised to be carried forward. The directors state that a very large proportion of the loss is due to the depreciation in the value of stock, and that the remainder is the result of the disastrous effects of the coal strike, shorter hours of work, labour difficulties, and other such causes. No dividend is, of course, to be paid on the ordinary shares in respect of the accounts now published. The price of the shares is nominally 12s. 6d., though actually it is not as good as this, and the melancholy figures have had no effect upon other companies' shares.

The British Thomson-Houston Co. has made an issue of £1,500,000 7 per cent. mortgage debenture stock at 92½, brief particulars of which were given here last week. The subscription lists could have been kept open until Thursday, but they were shut on Monday, there being a rush for the stock. A capitalised dividend, out of capital reserves account, of 10 per cent. was paid on the ordinary shares in July, 1920. Previously to that, nothing had been paid on the ordinary for 17 years; the shareholders received 4 per cent. per annum for nine months of 1902-3. The preference dividends fell into arrear from 1904 to 1919, but this was satisfied in full, in July, 1920, by the allotment of 210,000 fully-paid £1 ordinary shares, a sum of £210,000 out of capital reserve account having been capitalised for this purpose.

Electricity supply shares hold their prices, and Kensingtons are better at 4½.

Underground stocks have moved up a little after their recent reaction, although the Income Bonds of the Underground Electric Railways are again a point down. The company's £10 shares, however, have risen to 35s. Brazilian Tractions at 30 are one higher, and Mexican Light and Power 1st mortgage bonds at 53½ have equally improved. Mexican Government bonds have been going up by points at a time this week, the buying being traced to New York sources. Up to the present, however, the Utility companies have not participated in this attention. The rubber share market continues firm, with rubber itself still a trifle under a shilling per lb. Engineering shares keep steady, with Babcock & Wilcox 2 3/16. The armament group is a little shaky, though Vickers, after a dip to 9s., rallied to 9s. 6d. Siemens ordinary at 21s. 3d. have recovered the 1s. net dividend deducted a week ago, and the preference shares at 25s. 6d. are higher on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Nov. 22, 1921.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	2	1	6½	—	£9 18 0
Charing Cross Ordinary	7	8	4½	—	8 17 10
do. do. do. 4½ Pref.	4½	4½	6⅛	—	7 4 4
Chelsea	4	6	8½	—	9 4 8
City of London	13	14	26 9	—	10 9 6
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	8	8	8⅞	—	9 10 4
do. do. 5 per cent. Pref.	6	6	7⅞	—	7 10 0
Kensington Ordinary	7	9	4⅞	+ ⅛	9 9 6
London Electric	2½	2½	1	—	7 10
do. do. 6 per cent. Pref.	6	6	9	—	10 0 0
Metropolitan	6	7	9⅞	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2⅛	—	7 13 2
St. James' and Pall Mall	12	12	6⅞	—	8 17 10
South London	6	7	2⅝	—	10 13 2
South Metropolitan Pref.	7	7	16/3	—	8 12 4
Westminster Ordinary	10	10	5⅞	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	89½	—	7 5 7
do. Def.	1½	1½	17	—	8 16 6
Chile Telephone	6	6	5⅛	—	5 17 3
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	10	10	16⅜	— ⅛	6 2 2
Eastern Tel Ord.	10	10	163½	—	6 2 4
Globe Tel. and T. Ord.	10	10	16⅜	—	6 2 2
do. do. Pref.	6	6	9½	—	6 9 9
Great Northern Tel.	22	24	25	—	9 12 0
Indo-European	10	10	30	—	8 6 8
Marconi	25	15	1⅝	— 1/8	9 12 6
Oriental Telephone Ord.	12	12	2	— ⅛	*6 0 0
United R. Plate Tel.	8	8	5½	+ 1/8	*7 0 8
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	16⅜	—	*6 1 0
Home Rails.					
Central London Ord. Assented	4	4	40½	—	8 1 8
Metropolitan	1½	1½	23⅜	+ ⅛	6 7 5
do. District	Nil	Nil	16	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	4	2	65½	—1	*4 13 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	22	—	10 9 6
do. do. 2nd Pref.	Nil	5½	21½	—	10 4 8
do. do. 5 per cent. Deb.	5	5	64½	—	7 15 0
Brazil Tractions	Nil	Nil	10	+1	Nil
British Columbia Elec. Rly. Pfd.	5	5	58	—	8 12 4
do. do. Preferred	5	93/-	51	—	*9 5 0
do. do. Deferred	8	124/-	53	—	*11 13 10
do. do. Deb	4½	4½	58½	—	7 5 4
Mexico Trams. 5 per cent. Bonds	Nil	Nil	52	—	—
do. do. 6 per cent. Bonds	Nil	Nil	56	—	Nil
Mexican Light Common	Nil	Nil	10	—	Nil
do. Pref.	Nil	Nil	25	—	Nil
do. 1st Bonds	Nil	5	53½	+1	9 7 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	2 3/16	—	6 18 6
British Aluminium Ord.	10	10	14/6	+9d.	—
British Insulated Ord.	15	15	1½	—	10 0 0
Callenders	15	15	1½	—	10 18 2
" 6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	5/3	+3d.	—
do. do. 5 per cent. Deb.	5	5	65	—2	7 9 1
Electric Construction	10	10	17/6xd	+6d.	11 8 6
English Electric	8	8	10/-	—9d.	16 0 0
do. Pref.	6	6	15/9	+ 3/16	8 14 6
Gen. Elec. Pref.	6½	6½	17/-	+6d.	7 13 0
do. Ord.	10	10	17/6	+9d.	11 8 6
Henley	15	15	1½	+9d.	10 0 0
do. 4½ Pref.	4½	4½	3¼	+ 1/16	6 8 8
India-Rubber	10	—	1	— 1/16	
Met.-Vickers Pref.	8	8	11⅞	—	8 16 8
Siemens Ord.	10	10	21⅛xd	—	*9 8 3
Telegraph Con.	20	20	21½	—	*5 11 9

* Dividends paid free of Income Tax.

POWER FACTOR.—III.

By E. W. DOREY, A.M.I.E.E.

Capital outlay is not the only item influenced by low power factor, there being the important question of increased running costs due to increased losses in the generating plant and distribution system, and also bad voltage regulation.

The following table shows the value of current in a circuit with varying power factor:—

Power factor	...	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3
Total current	...	100	111	125	143	167	200	250	333
Idle current	...	—	11	25	43	67	100	150	233

At 70 per cent. power factor all current-carrying plant, viz., generators, transformers, switchgear, and cables, must be 43 per cent. greater than would be necessary at unity p.f., or in other words, 30 per cent. of the total current in the mains is idle (so called wattless), but heats up all current-carrying plant.

The fuel costs of an electricity supply undertaking may be as much as 80 per cent. of the total running costs. Considerable capital expenditure will often be incurred in the installation of more efficient plant in the power station to reduce the generation cost per unit sent out by, say, 5 per cent., as thereby, with 80 per cent. fuel costs, the overall generator costs could be reduced by 4 per cent. of the total. Supposing the number of units sent out is 20,000,000 and cost per unit sent out .8d., then 4 per cent. saving is the equivalent of approximately £2,660 per annum capitalised at 10 per cent.; this equals, say, £26,000.

The revenue of an undertaking is derived from the units sold and metered on the consumers' premises, and therefore the losses in the distribution system play an important part in fixing the rate charged per unit. Low power factor means increased losses both inside and outside the generating station, and under otherwise equivalent conditions a system with an average power factor of 60 per cent. must charge more per unit than one with, say, 90 per cent. power factor, as the current flowing is as 167 to 111 (see table above); low power factor is therefore as vitally the concern of the consumer as of the supply undertaking.

A consideration of the following points shows how the losses, and therefore the fuel costs per unit sold, are affected by low power factor.

Steam Turbines (or other prime movers).—If the driven alternator is designed for 80 per cent. p.f. and the station p.f. is 60 per cent., it follows that the set cannot be run at more than 75 per cent. of full kW load, owing to kVA limitation of the alternator; this means greater steam consumption per unit, and possibly running, say, three sets where with high p.f. two would do. The losses may quite easily be increased in such circumstances by 2-4 per cent.

Alternators.—The following table shows the approximate percentage increase in excitation of modern alternators due to low power factor:—

Power factor	...	1.0	0.9	0.8	0.7
Per cent. excitation	...	100	106	110	112

With the excitation value about 1 per cent. of the kW output of the machine, this item is not very considerable, but it all adds to the losses.

Mains Losses.—The increase in the mains losses with low power factor is usually the greatest factor of all, as the losses vary directly as the square of the current. *Therefore, with 70 per cent. power factor, the losses are approximately double those at unity p.f.*

Taking as an example, a single high-pressure feeder between two points with unity power factor and a current of, say, 100 amps., the C^2R losses are found to be approximately 30 kW, or 30 units per hour; then with 60 per cent. power factor the current will rise to 167 amps., and the losses will increase as $100^2 : 167^2$, *i.e.*, the losses would be 30 kW × $167^2/100^2$ = 84 kW, an increase in the mains losses of not less than 180 per cent. The difference of 54 kW, say, for eight hours a day and 300 days a year, equals approximately 130,000 units, which, at 1d. per unit, equals £540, or capitalised at 10 per cent., £5,400. An investigation of the reductions of mains losses possible by improvement of power factor is well worthy of the closest consideration.

Transformer Losses.—Transformer losses are a very considerable item in the total losses of the distribution system, and there are two points to consider:—

1. The increased losses due to the necessity for bringing into circuit additional transformers to meet increased kVA demand with low power factor.

2. The increased losses in the transformer itself due to low power factor.

Thus, a load of 1,000 kW at unity p.f. could be dealt with by two 500-kVA transformers, and the losses would be about 1.6 per cent. of the kW output, *i.e.*, 16 units per hour. At 70 per cent. p.f., 1,430 kW, a third 500-kVA transformer would be switched in, thus increasing the losses to a total of about 2.35 per cent. of the kW output, *i.e.*, 23.5 units per hour. The increased losses are therefore approximately 7.5 units per hour, and in a year would be perhaps as much as 25,000 units. By the judicious installation of plant for the improvement of power factor, it should be possible, in the majority of cases, to reduce the losses in both generation and transmission by a considerable percentage. A reduction of these losses must result in a lower price per unit sold. The important bearing of power factor, not only on capital expenditure but on the losses in the generation and supply of electrical energy, is receiving, and must continue to receive, increasing attention on the part of supply engineers.

Is it conceivable that any supply undertaking (and there are such) can continue to operate on sound commercial lines with an overall power factor of 60 per cent., when of every 167 kVA in the mains 67 kVA is idle? The consumer is to blame for low power factor, and the consumer must be made to pay for it.

ELECTRICAL EXPORTS OF THE UNITED STATES.

Below are given the values (and quantities where available) of electrical machinery and appliances exported from the United States of America during 1920, showing the principal countries of destination. For purposes of comparison the figures for 1919 are added, and notes of increases or decreases are made.

	1919 Dol.	1920 Dol.	Inc. or Dec. Dol.
Dynamos or generators.—			
Total ...	5,800,000	7,796,000	+ 1,996,000
To France	782,000	615,000	− 167,000
,, Italy	344,000	245,000	− 99,000
,, Norway	141,000	161,000	+ 20,000
,, Great Britain	92,000	152,000	+ 60,000
,, Canada	775,000	700,000	− 75,000
,, Mexico	135,000	209,000	+ 74,000
,, Cuba	368,000	637,000	+ 269,000
,, Argentina	111,000	71,000	− 40,000
,, Brazil	157,000	193,000	+ 36,000
,, Chile	66,000	315,000	+ 249,000
,, Uruguay	131,000	70,000	− 61,000
,, China	314,000	714,000	+ 400,000
,, Hong Kong	91,000	104,000	+ 13,000
,, India	146,000	798,000	+ 652,000
,, Japan	1,054,000	1,403,000	+ 349,000
,, Australia	156,000	167,000	+ 11,000
,, British South Africa...	22,000	70,000	+ 48,000
Carbons.—			
Total ...	1,392,000	1,478,000	+ 86,000
To Italy	45,000	63,000	+ 18,000
,, Norway	101,000	16,000	− 85,000
,, Great Britain	83,000	74,000	− 9,000
,, Canada	759,000	938,000	+ 179,000
,, Japan	73,000	132,000	+ 59,000

	1919 Dol.	1920 Dol.	Inc. or Dec. Dol.
Batteries.—			
Total ...	5,998,000	6,634,000	+ 636,000
To Norway	212,000	79,000	− 133,000
,, Great Britain ...	526,000	469,000	− 57,000
,, Canada	1,780,000	1,834,000	+ 54,000
,, Cuba	276,000	406,000	+ 130,000
,, Argentina	377,000	448,000	+ 71,000
,, China	153,000	147,000	− 6,000
,, Australia	412,000	365,000	− 47,000
,, New Zealand	229,000	227,000	− 2,000
,, British South Africa...	311,000	251,000	− 60,000
,, British India	145,000	230,000	+ 85,000
,, Brazil	163,000	190,000	+ 27,000
,, Mexico	175,000	302,000	+ 127,000
,, Spain	62,000	206,000	+ 144,000
,, France	84,000	114,000	+ 30,000
Fans.—			
Total No. ...	76,500	72,200	− 4,300
$ ...	1,421,000	1,365,000	− 56,000
To Canada, No.	22,000	11,000	− 11,000
$	289,000	116,000	− 173,000
,, Argentina, No. ...	5,000	6,000	+ 1,000
$ ...	91,000	138,000	+ 47,000
,, China, No.	12,000	4,000	− 8,000
$	278,000	83,000	− 195,000
,, British India, No. ...	12,600	16,000	+ 3,400
$ ...	322,000	344,000	+ 22,000
,, Cuba, No.	2,500	10,000	+ 7,500
$	49,000	192,000	+ 143,000
Heating and cooking apparatus.—			
Total ...	1,580,000	1,801,000	+ 221,000
To Norway	274,000	198,000	− 76,000
,, Great Britain ...	107,000	152,000	+ 45,000
,, Canada	314,000	346,000	+ 32,000
,, Argentina	95,000	108,000	+ 13,000
,, Japan	96,000	79,000	− 17,000
,, Australia	79,000	139,000	+ 60,000
,, Mexico	65,000	112,000	+ 47,000
Insulated wire and cables.—			
Total ...	8,815,000	8,209,000	− 606,000
To Belgium	116,000	73,000	− 43,000
,, Denmark	230,000	58,000	− 172,000
,, France	135,000	102,000	− 33,000
,, Netherlands	473,000	298,000	− 175,000
,, Norway	1,671,000	592,000	− 1,079,000
,, Portugal	110,000	38,000	− 72,000
,, Spain	107,000	78,000	− 29,000
,, Sweden	139,000	125,000	− 14,000
,, Great Britain	258,000	450,000	+ 192,000
,, Canada	198,000	271,000	+ 73,000
,, Mexico	340,000	586,000	+ 246,000
,, Cuba	550,000	944,000	+ 394,000
,, Argentina	691,000	465,000	− 226,000
,, Brazil	979,000	1,267,000	+ 288,000
,, Chile	300,000	136,000	− 164,000
,, Colombia	53,000	98,000	+ 45,000
,, Peru	144,000	165,000	+ 21,000
,, Uruguay	278,000	55,000	− 223,000
,, China	311,000	562,000	+ 251,000
,, Japan	72,000	49,000	− 23,000
,, British India	192,000	186,000	− 6,000
,, Dutch East Indies ...	292,000	112,000	− 180,000
,, Australia	128,000	55,000	− 73,000
,, New Zealand	25,000	80,000	+ 55,000
,, Philippine Islands ...	291,000	431,000	+ 140,000
,, British South Africa...	233,000	34,000	− 199,000
Interior wiring supplies and fixtures.—			
Total ...	2,319,000	3,386,000	+ 1,067,000
To Norway	107,000	43,000	− 64,000
,, Canada	493,000	957,000	+ 464,000
,, Mexico	153,000	209,000	+ 56,000
,, Cuba	221,000	379,000	+ 158,000
,, Argentina	154,000	163,000	+ 9,000
,, Brazil	247,000	252,000	+ 5,000
Metal filament lamps.—			
Total No. ...	17,072,000	16,143,000	− 929,000
$ ...	4,674,000	4,052,000	− 622,000
To Italy, No.	583,000	330,000	− 253,000
$	198,000	81,000	− 117,000
,, Canada, No.	3,061,000	3,907,000	+ 846,000
$	902,000	974,000	+ 72,000
,, Mexico, No.	1,632,000	1,146,000	− 486,000
$	352,000	317,000	− 35,000
,, Cuba, No.	984,000	2,074,000	+ 1,090,000
$	310,000	606,000	+ 296,000
,, Argentina, No. ...	1,424,000	683,000	− 741,000
$ ...	448,000	153,000	− 295,000
,, Brazil, No.	2,987,000	2,249,000	− 738,000
$ ...	687,000	465,000	− 222,000
,, Australia, No. ...	956,000	479,000	− 477,000
$ ...	232,000	117,000	− 115,000
,, British South Africa, No.	489,000	245,000	− 244,000
$	127,000	69,000	− 58,000
Lamps, arc	17,000	25,000	+ 8,000
,, *carbon filament*...	203,000	115,000	− 88,000

	1919 Dol.	1920 Dol.	Inc. or Dec. Dol.
Magnetos, sparking plugs, &c.—			
Total ...	3,035,000	3,601,000	+ 566,000
To Italy	526,000	144,000	− 382,000
,, Great Britain	195,000	365,000	+ 170,000
,, Canada	633,000	1,030,000	+ 397,000
,, Argentina	128,000	186,000	+ 58,000
,, India	101,000	210,000	+ 109,000
,, Japan	180,000	126,000	− 54,000
,, Australia	278,000	161,000	− 117,000
,, New Zealand	89,000	119,000	+ 30,000
,, British South Africa...	85,000	108,000	+ 23,000
Meters and measuring instruments.—			
Total ...	2,891,000	2,677,000	− 214,000
To Canada	402,000	489,000	+ 87,000
,, Argentina	208,000	66,000	− 142,000
,, Brazil	327,000	132,000	− 195,000
,, China	136,000	148,000	+ 12,000
,, Japan	639,000	441,000	− 198,000
,, Italy	99,000	102,000	+ 3,000
,, Australia	218,000	111,000	− 107,000
Motors.—			
Total ...	10,635,000	13,422,000	+ 2,787,000
To France	591,000	701,000	+ 110,000
,, Great Britain ...	877,000	1,240,000	+ 363,000
,, Canada	1,611,000	2,404,000	+ 793,000
,, Mexico	428,000	398,000	− 30,000
,, Cuba	505,000	972,000	+ 467,000
,, Brazil	544,000	449,000	− 95,000
,, China	443,000	557,000	+ 114,000
,, India	572,000	477,000	− 95,000
,, Japan	1,068,000	1,486,000	+ 418,000
,, Belgium	153,000	704,000	+ 551,000
,, Italy	143,000	406,000	+ 263,000
,, Spain	344,000	426,000	+ 82,000
,, Argentina	317,000	318,000	+ 1,000
,, Australia	760,000	660,000	− 100,000
Rheostats and controllers.—			
Total ...	515,000	708,000	+ 193,000
Switches and accessories.—			
Total ...	3,565,000	4,439,000	+ 874,000
Telegraph apparatus.—			
Total ...	831,000	714,000	− 117,000
To Great Britain ...	200,000	66,000	− 134,000
,, Canada	198,000	84,000	− 114,000
,, Japan	97,000	73,000	− 24,000
Telephones.—			
Total ...	3,783,000	3,899,000	+ 116,000
To France	197,000	27,000	− 170,000
,, Italy	204,000	132,000	− 72,000
,, Netherlands	157,000	10,000	− 147,000
,, Norway	189,000	20,000	− 169,000
,, Spain	167,000	129,000	− 38,000
,, Great Britain	233,000	276,000	+ 43,000
,, Canada	678,000	810,000	+ 132,000
,, Brazil	380,000	408,000	+ 28,000
,, China	158,000	234,000	+ 76,000
,, Japan	120,000	76,000	− 44,000
,, Dutch East Indies ...	66,000	143,000	+ 77,000
,, Australia	182,000	188,000	+ 6,000
,, New Zealand	132,000	77,000	− 55,000
Transformers.—			
Total ...	3,788,000	4,803,000	+ 1,015,000
To France	194,000	125,000	− 69,000
,, Italy	224,000	30,000	− 194,000
,, Netherlands	144,000	18,000	− 126,000
,, Spain	230,000	331,000	+ 101,000
,, Mexico	235,000	214,000	− 19,000
,, Brazil	538,000	565,000	+ 27,000
,, Chile	241,000	60,000	− 181,000
,, China	193,000	330,000	+ 147,000
,, Japan	366,000	455,000	+ 89,000
,, Australia	273,000	254,000	− 19,000
,, Canada	132,000	167,000	+ 35,000
,, India	116,000	748,000	+ 632,000
All other electrical machinery and appliances (except locomotives) ...	27,827,000	32,868,000	+ 5,041,000
Grand total of electrical machinery and appliances (except locomotives) ...	89,090,000	102,000,000	+12,910,000
Locomotives, electric.—			
Total ...	836,000	880,000	+ 44,000

New Cable Armouring.—*Dagens Nyheter* learns that the Siemens-Schuckert group has bought the patent rights for Germany of the new alloy for cable armouring invented by M. Stenquist, an engineer in the service of the Swedish State Telephone Office.—*Reuter's Trade Service* (Stockholm).

CHINA'S INDUSTRIAL FUTURE.

A Promising Market for Machinery.

The report on the trade situation in China*, to which reference is made in a leaderette appearing in this issue, shows that China is beginning to utilise her own raw materials by manufacturing for herself many of the goods which she has previously had to import from abroad. The standard of living is rising. The people have overcome to a large extent their traditional dislike and suspicion of foreigners and foreign ways, and are rapidly assimilating Western customs and Western modes of living; consequently foreign style goods are ceasing to be luxurious and becoming necessaries.

In Mr. Fox's opinion these tendencies will redound to the advantage of British trade, for the Chinese while relying more and more on their own industries to supply the wants that intercourse with foreign nations has created, will purchase, far more freely than they have done in the past, the better class of goods that they cannot produce at home. In the process of this industrial development there will be a demand for every description of foreign machinery and mechanical appliances which should keep British manufacturers busy for many years to come.

Railway Schemes.

The report mentions a number of railway schemes in progress or in contemplation, that which is most urgently needed being probably the completion of the Hankow-Canton line, work on which has long been interrupted owing to financial difficulties and disturbed political conditions in the southern provinces. There is still a gap of about 270 miles between the railheads at Chu Chou in Hunan and Hsiu Chow in Kuangtung, and, owing to the hostility existing between the governments of the respective provinces, attempts to continue constructional work have hitherto proved unsuccessful. It is reported, however, that a definite arrangement has now been arrived at for financing the continuation of the Hunan section to Henchow, funds to a total amount of $400,000 being set aside each month from the revenues of the Peking-Hankow, Tientsin-Pukow, Peking-Mukden, and Peking-Suiyuan railways, and that work will be started immediately.

It may be mentioned that valuable work was accomplished last year by a commission of railway experts, appointed by the Ministry of Communications. The Commission, which had the assistance of six foreign advisers, collected much useful information with regard to China's railway system, having particularly in view the need for devising means to standardise railway equipment.

Coal and Iron Production.

The coal mining industry has made considerable strides during the past few years; the reserves of iron ore are reckoned at about 1,000 million tons. Under contracts with Japanese smelters, the latter hold options on the output of many of the mines in China up to a total of approximately 1,000,000 tons per annum, but owing to the industrial depression in Japan since the war these options have not been fully exercised during the past few years. With a business revival in Japan, however, the export of ore to that country will probably increase rapidly. At the same time the development of the smelting industry in China is also growing, and a much larger production of ore is anticipated in the near future. The following is a list of iron works already in operation or to be erected within the next few years:—

Name.	Approx. capacity in tons.	Date of opening.
Hanyang	150,000 ...	In operation.
Tayeh	240,000 ...	End of 1921.
Penchihu	80,000 ...	In operation.
Anshanchan	100,000 ...	Partly in operation.
Lungyen	80,000 ...	End of 1921.
Yangtse Engineering	20,000 ...	In operation.
Kungch'angling ...	30,000 ...	1922 (?).
Chinwantao ...	80,000 ...	1922 (?).

Manufacturing Enterprises.

After referring to the hindrances which have occurred to development during the past two years, particularly the disturbed condition of the country and the difficulty of obtaining machinery, the report points out that China's industries have by no means stopped growing, and a journey through the country by rail or river reveals the transformation that is everywhere taking place in her cities, which are rapidly losing their mediæval appearance and changing into busy hives of modern industry. Shanghai, Hankow, Tientsin and Canton lead the way, but in almost every provincial capital and considerable commercial centre throughout the land, modern mills and factories are springing up which are turning out in ever increasing quantities articles which China has in past years been obliged to import from foreign countries. The hindrances to development above referred to, though still existent, are less serious than they were. Communications are slowly improving—that the Chinese have at least come to realise the importance of roads and road-building is noticeable in the neighbourhood of every large town—attempts, spasmodic but of hopeful augury, are being made in the cotton and silk-producing districts to improve the quality of these valuable products, and the successful working of some of China's newest mills and factories compels the admission that the Chinese are at last beginning to understand the value of efficient organisation and honest management.

Among the more important industrial enterprises may here be mentioned:— Cotton spinning and weaving mills, flour, bean and oil mills, iron and steel works, shipbuilding and engineering works, cement works and paper mills.

The Industries of Shanghai.

During the last decade Shanghai has become a manufacturing centre of considerable importance, its local industries now including 25 cotton mills, 16 flour mills, 15 silk mills, paper, oil, and timber mills, cigarette, soap, and candle factories, a brewery and several aerated water factories, and five shipbuilding yards. The report contains statistical and other data regarding the success of the electrical undertaking, taken from reports of the Chief Electrical Engineer.

The Import of Machinery.

Bearing in mind what has been said about the growth of manufacturing industries, it is not surprising to find that imports of machinery rose from 4.6 million Haikwan taels in 1913 to 22.3 million Haikwan taels in 1920. Practically every class of machinery is now in demand, and it may be said that China's orders are only restricted by the limited ability of Great Britain and America to supply her wants. The following list of some of the principal lines imported last year give some indication of the requirements of this market:—Machinery for cotton mills, cigarette factories, flour mills and oil mills, boilers and engines, knitting and sewing machines, hand and machine tools, railway materials (rails, sleepers, rolling stock and locomotives), telegraph and telephone materials, electric power plants (including cables, insulated wire, motors and meters, switches and transformers), motor-cars, motor cycles, motor trucks and motor-car accessories.

The increased sale of electrical materials is especially interesting, imports having risen from 2.3 million taels in 1913 to 6.3 millions in 1920. Nearly every large city in China is either provided with an electric installation for light and power purposes or is in treaty for one, and private power stations and small electric power plants for household use are becoming increasingly popular. Japan still has the bulk of the business in the cheaper kinds of electrical accessories, although the competition of Chinese lamp factories in Shanghai and elsewhere is beginning to make itself felt. British manufacturers of electrical materials are now well represented in China, and would secure a large share of the business offering if they could rely on prompter shipments. As it is they have some difficulty in meeting American competition.

Reference is made to the keen competition of the Americans in the engineering trade, which is especially serious in the matter of the supply of locomotives and rolling stock to Chinese Government railways. It is reported that contracts have been signed by American firms which, while guaranteeing delivery in from six to nine months under penalty, provide for payment being extended over a period of five and even as much as seven years. It is obvious that no British manufacturer or merchant house could afford to grant such liberal terms without some strong financial backing, and the question arises whether the time has not come to consider the establishment of an Anglo-Chinese Industrial Bank which would assist our manufacturers in financing large contracts involving deferred payments. It may be noted that similar banks have been formed by the Japanese, French, Italians, and quite recently by the Americans.

It is very satisfactory to note that British manufacturers are taking an active and intelligent interest in the China market, and that the reputation of their goods is second to none.

* "Situation of China." Department of Overseas Trade. H.M. Stationery Office. 1s. 9d.

The Henley Wiring System.—In view of the discussion in connection with the use of lead-covered wiring systems which has been going on for some time in our "Correspondence" columns, the arrival of a booklet issued by Messrs. W. T. Henley's Telegraph Works Co., Ltd., is very opportune. Faults which have been reported by correspondents were practically all due to faulty erection, and this booklet is designed to educate or assist contractors on this important point. Bonding and earthing are particularly emphasised in an opening "warning." Such details as fixing to various surfaces, stripping, and jointing, are fully dealt with, and, in addition, numerous wiring diagrams for ordinary and peculiar circuits are included.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Small Kinema Projector.

Contact, the sales journal of the Westinghouse Electric and Manufacturing Co., gives particulars of a kinema projector made by Withington-Hunting, Inc., of New York City, and fitted with a Westinghouse motor. The "Beacon" projector (fig. 1) is made in two models for standard or safety standard films, and it will project a picture the size of a postcard from a distance of two feet, or the usual kinema theatre size from a distance of ninety feet. The film may be stopped at any time, and a stationary picture projected for an indefinite period without danger of fire or other injury to the film or machine. Such a projector can be used to advantage in the windows of stores to show a continuous motion picture on a screen of ground glass hung in the window.

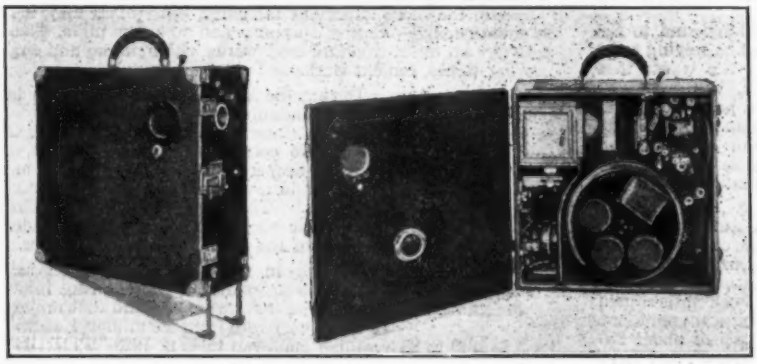


Fig. 1.—The "Beacon" Kinema Projector.

A Combined Coal and Electric Range.

The *Electrical Review* (Chicago) recently published details of a new American cooking range designed for both coal and electricity. The complete appliance is about 5 ft. in height, 46 in. long, and 35 in. wide. As will be seen from the illustration (fig. 2), the electric oven is mounted on the top of the range; this oven is 19 in. wide, 15 in. deep, and 13 in. high. It is lined with "rustless" sheet metal, and has light aluminium-plated racks and two heating elements. There are also two cooking or boiling rings in the top of the coal-fired stove.

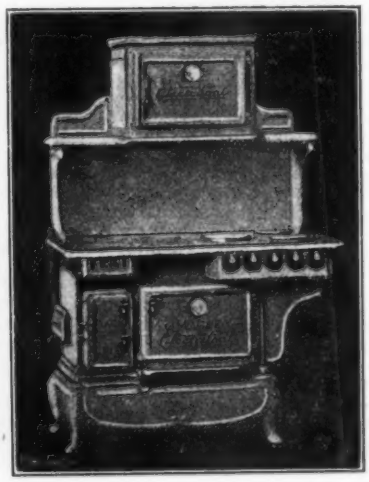


Fig. 2.—The Magee "Electricoal" Range.

Each of the elements is connected to a three-heat switch. These switches are arranged in the front of the appliance, and both ovens are fitted with reliable temperature indicators. The full electrical load is 5,900 W. The range is manufactured by the Magee Furnace Co., of Boston, and is known as the "Electricoal" range.

An Adaptable Hot-Plate.

The Tucker Manufacturing Co., of Cleveland, Ohio, has introduced an electric hot-plate adaptable to the top of practically any stove. This is a conical cast-iron piece tapering from 9.5 in. dia. at the top to 6 in. dia. at the bottom. A circular heating element is fitted in the top of this casting, and the leads from this may be taken to a wall plug.

A Reavell Air Compressor.

The old "crescent type" of rotary air compressor had a drum or rotor with radial sliding blades rotating eccentrically in a stationary casing. The principal fault of this design was that any attempt to use high speeds resulted in excessive wear of the casing and, consequently, low speeds were employed.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich, have overcome this objection in the following way.

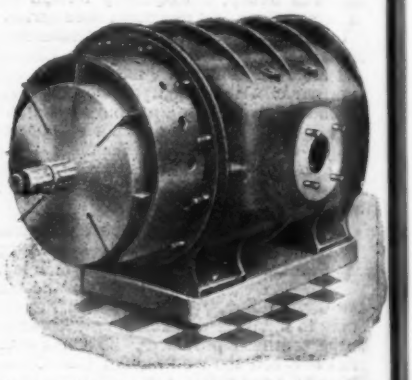


Fig. 3.—The Reavell Rotary Air Compressor.

While the rotor and stationary casing are retained, the blades of the former are not in contact with the interior of the latter. A rotary drum is fitted between the two. This is mounted on roller bearings in the fixed end covers of the casing and rotates freely inside the casing with a very fine clearance. As shown in fig. 3, the drum is perforated and the air passes freely through these holes. When the rotor begins to revolve, the blades are pressed against the inner surface of the drum by centrifugal force, and the drum is carried round by this pressure. Owing to the possibility of running this compressor at a high speed it can be direct coupled to an electric motor or a high-speed engine.

The Phœnix Lighting Set.

Yet another addition has been made to the list of small British lighting and power sets. This is the "Phœnix" plant (fig. 4) made by the Phœnix Ironworks Co., Littleborough, near Manchester. The engine is of the horizontal type, arranged to run on paraffin at a speed of 650 r.p.m., and developing from 1½ to 2 h.p. Two heavy balanced flywheels and an efficient governing system maintain even running. The cylinder is fitted with a removable liner which can be replaced when worn or scored at a comparatively low cost. The fuel tank is in the base, and paraffin is supplied to the mixer

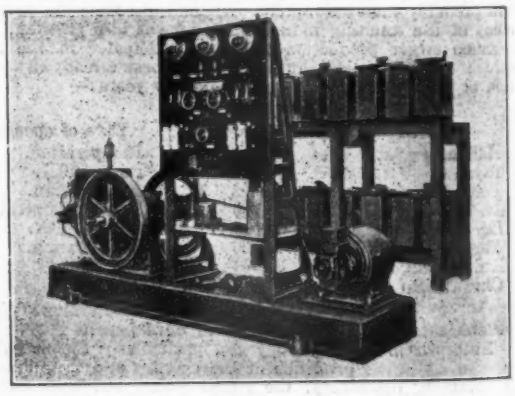


Fig. 4.—The "Phœnix" Lighting Set.

or carburettor by a small plunger pump. Magneto ignition is employed. The dynamo, which is belt-driven, has an output of 1 kW at a speed of 1,400 r.p.m. It is fitted with a large commutator and ring oiler bearings. Current is generated at a pressure of from 25 to 35 V. The switchboard is an enamelled slate panel 2 ft. square and 1 in. thick. It bears charge and discharge ammeters, a voltmeter, two 20-A, d.p. knife switches, four s.p. handle-type fuses, an automatic cut-out, an 8-point shunt-regulating switch and resistance, a 4-way battery switch, and a 2-way voltmeter switch. The set is completed by a "D.P." battery. The engine and dynamo are mounted on a heavy cast-iron bed 6 ft. long, 18 in. wide, and 6 in. deep, and the switchboard is also erected upon this, supported by two cast-iron brackets.

TELEPHONE LINE WORK IN THE UNITED STATES.

By E. S. BYNG, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

In view of the difference between the methods of telephone-line construction adopted in England and the U.S.A., a description of the essential features of the present-day practice in America should be of interest to British telephone engineers. Mr. Byng's object is to place before members of the Institution observations he made during a trip to the U.S.A. upon some of the practices adopted in line construction work. The treatment is mainly descriptive, and, in general, no attempt is made to estimate the advantages or disadvantages of American methods in comparison with those adopted in other countries.

The author points out that America now contains about 70 per cent. of the telephones of the world, and the engineers concerned have, therefore, enjoyed a better opportunity of developing and improving their plant methods than has been offered elsewhere. Their work has been carried on in comparatively new cities which were growing rapidly, and among people who regarded the telephone not as a luxury, but as a necessity of business and social life. The field, moreover, was left open to commercial enterprise. Telephone development in America was thus stimulated to a degree to which no other country affords a parallel.

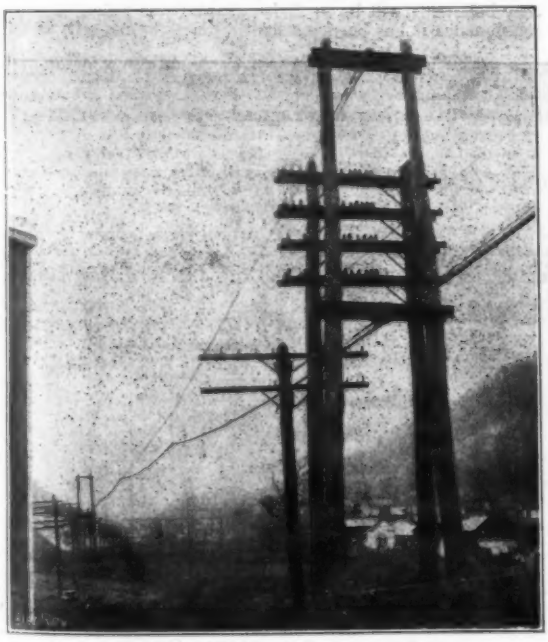
The American Telephone and Telegraph Co. and its associated and connecting companies (commonly known as the Bell system) control approximately 12,600,000 telephone stations. In addition, there are about 900,000 stations owned by independent companies, not connected in any way with the Bell system, but competing directly with it in certain territories. The entire country is covered by these associated companies. In describing American engineering and constructional methods, it is explained that, in general, an underground conduit system is adopted in all main thoroughfares and business streets; in the outskirts of a city and for distribution work, aerial cables are used extensively. At one time such cable was considered to be a transition stage between open wire and underground construction, but it is now settled policy, where local conditions permit, to run all long-distance cables aerially. The advantages and disadvantages of aerial cable, as compared with underground cable, are fully discussed by the author, who points out that many of the past weaknesses of this type of cable have been eliminated, and that the last few years have demonstrated that where only cables are carried, the route is practically immune from storm damage.

The methods of constructing underground conduit and of laying underground cable are explained, and it is remarked that American engineers consider that no kind of lubricant forms an effective preservative against chemical or electrolytic action on the lead sheath of cable. The advantages of the American "block" system are briefly mentioned to show that the system is an exceedingly flexible one, and that, after completion of the main scheme, telephone service can be readily supplied to any house in the block at a small cost. Motor transport is much more largely used on telephone work in the U.S.A. than in England because it is cheaper. The New York Telephone Co., for instance, has a fleet of over 1,000 vehicles of various descriptions and a staff of 250 engaged on maintenance and repairs. Nevertheless, the companies are satisfied that the expense is fully justified by the resulting improvement in efficiency. The high rates of pay

5-ton Tank-type Tractor hauling cable drums over mountainous country.

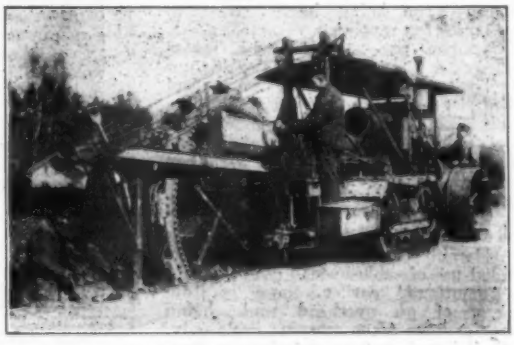
Pulling winch 3,600 ft. away (note signaller on pole). Open wires to be superseded; arm temporarily lowered to avoid contacts.

Aerial Cable Transport and Installation.



Long span, with three pick-ups from auxiliary suspension strand. Open wires temporarily moved (to be superseded by cable).

Special Overhead Construction.

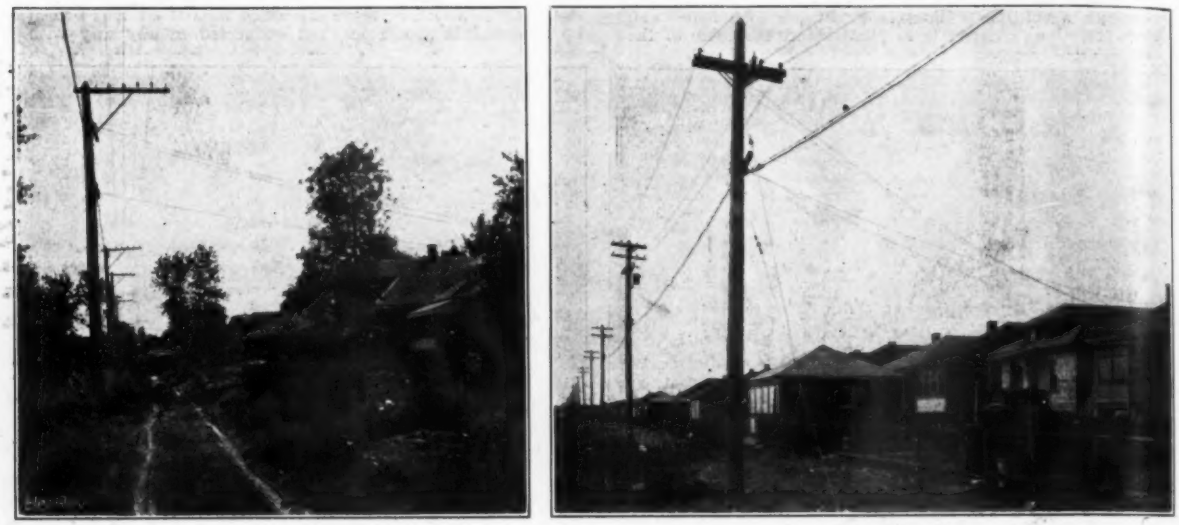


Trench Excavation Machine, showing digging prongs on periphery of 6-ft. wheel.

"Ditching" Machine.

in America have necessitated the use of many labour-saving appliances, amongst which are excavating machines for trench work; a modified farmer's plough for filling in trenches; concrete mixers; tamping machines; pole hole excavators; pole erectors; pumps; air-driven drills; trucks carrying derricks or shear legs; and trucks to carry cable drums and power winches for drawing in cables.

With regard to maintenance, the author says that throughout the associated companies in America there appears to be a keen spirit of "service first," so that the public shall have



Lighting and power wires are carried on the upper arm, 48 in. above the telephone cable.
Covered "Drop-wire" Distribution from Aerial Cables on "Joint-use" Poles.

no legitimate ground for complaint. Under pre-war conditions the time taken for clearing faults in large cities was reduced to an average of about two hours per fault. This was made possible by the concentration of all testing and localising apparatus in one central office. When a fault is reported the test clerk at the exchange concerned telephones the details to the central test-office and connects the faulty line to a junction between the two offices. Necessary instructions are conveyed by means of loud-speaking telephones fitted at several parts of the apparatus floor of the exchange concerned. If a fault is outside the exchange, details are passed on to the fault-distribution officer, who is in telephonic communication with all the linesmen. Each large building, block, or group of blocks, is considered for maintenance purposes as a unit under the control of one man. The distribution officer has a large-scale map of the territory on the wall, with a small hook placed in the centre of each maintenance section. A ticket showing details of each current fault in this section is placed on the hook so that the necessary instructions can be given to the responsible linesman. Instrument faults which cannot be quickly remedied on site are dealt with by changing the instrument, the defective one being handed over to mechanics for repair.

Linesmen are provided with motor cycles or even small cars, when their use can be justified, to enable them to deal with long-distance subscribers' line faults. The section linesmen are also furnished with an exchange telephone at their private residences, so that they may be called out at any time in case of emergency.

Breakdowns of telephone line plant due to heavy sleet storms are now being considerably reduced by the more extended use of cable instead of open wire. As mentioned earlier, there is little danger of an overhead route being brought down when carrying cable only.

As it is not customary to impose pressure-tests upon completed cable works, or to use desiccators for raising low cable insulation, it might be expected that the maintenance of underground cables suffers in consequence. In practice this is not the case. In the central testing-offices careful records of all faults in underground cables are kept, and, if more than two or three pairs have to be changed over in the same cable for the purpose of clearing faults, suspicion is aroused and the necessary localisation tests are at once made with a view to determining the cause of the trouble. In this way incipient faults are generally detected and remedied. The universal practice of boiling-out all cable joints tends to delay a complete cable breakdown from any other cause than mechanical injury.

As a rule the provision of spare conduits is on a liberal scale, and a small stock of each size of cable is usually available in the vicinity of the main routes. The construction gangs are thus able to introduce a new length of cable into a duct adjacent to the one containing the faulty cable and change over the circuits within a few hours of a warning being given.

There is one feature which might be emphasised in connection with telephone construction work in the States. When the speed at which the work is carried out was first realised, it was imagined that the quality of the work would necessarily suffer. However, this was not the case. There are several reasons for this unexpected combination of high quality and rapid output. The ready acceptance of machinery and labour-saving devices by the working man, and the fact that they have been used to their full capacity, have been conducive to high efficiency. Trade unionism exists to some extent, but there is no desire to hamper output. The men readily accept any suggestion for speeding up the work, as they believe it will be to their advantage to reduce costs; in consequence it has been possible to place the majority of tele-

3-ton truck with racks for ladders, partitions for small stores, and searchlight for night work.
Motor Transport for Overhead Construction Gang.

phone workmen on the staff of the various companies rather than on an hourly basis. They receive a good weekly wage and enjoy privileges with regard to holidays, sickness, pensions, &c., which attract a good class of man. Another important point is the prospect of promotion to the higher grades for all ranks. It is a fact that any position in the Bell system is open to anyone who becomes qualified for it. Amongst the jointers are men who have graduated in a university; they have started at the bottom but are not content to remain

there. The actual hours worked are not long, but while the men are on duty they work hard and well.

Amongst the instances of rapid work quoted by the author are the following:—

Four miles of full-size cable, contained on 44 drums, drawn into a duct by 20 men, who performed the complete work of installation in 10 hours.

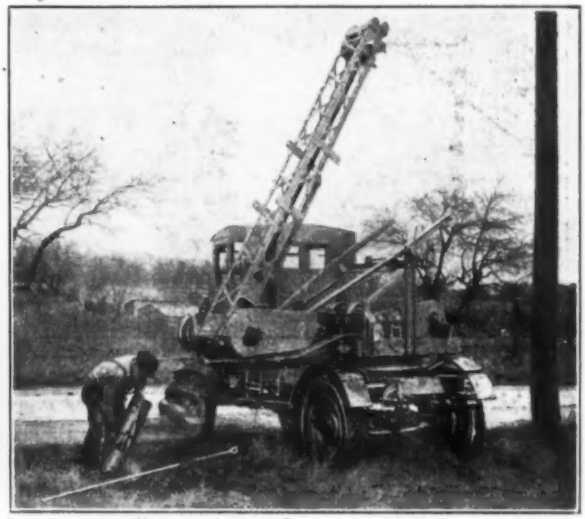
On a subscribers' cable the more experienced men can joint 150 pairs an hour, completing a 600-pair 10-lb. cable joint in an eight-hour day. Over 100 pairs an hour is usual.

The "ditching machine" can cut a trench 19 to 24 in. wide in a country road at the rate of 7 ft. per minute.

Major Brown, referring to the waxing of cable ends, said that it was the standard practice of the Post Office, but contractors were allowed to dispense with it if the standard insulation was obtained. Four large cable contractors did not boil out the joints, and did not use wax; the use of wax was attended with certain dangers from fumes and fire risk, and delayed the work. The Post Office had found wax useless for testing plumbed joints.

Mr. A. Moir referred to the value of subways for cables under streets; they were used in Paris, and in the newer London streets, and should always be provided when streets were being rebuilt.

Two men (driver and operator) with 3-ton truck, boring pole-hole.



Auger tilted for boring stay-hole; note "never-creep" anchor plate and rod.

Pole-hole Excavating Machine.

The tamping machine delivers 30 blows a minute (159 lb. dropped 4 ft.) whilst travelling at 3 ft. per minute, and does the work of 10 men.

A pole-hole 6 ft. deep and 18 to 24 in. in diameter can be excavated in three to five minutes by the mechanical auger. The author saw three men erect 45-ft. poles in a back-alley, boring the hole in 4½ minutes and planting the pole ready for tamping in 6½ minutes. When the holes have been excavated and the poles laid out in advance, 25-ft. poles can be erected at the rate of 40 per hour. The record is 300 poles in an 8-hour day by nine men with one 3-ton truck.

Cable is normally drawn in at 50 ft. per minute.

Discussion in London.

Sir Andrew Ogilvie said that the organisation of the American Associated Companies at headquarters was unparalleled elsewhere in the world; some 1,200 men were employed in research work. Glass insulators and wooden pins were not suitable for this country, where the climate was far more adverse to telephone work than that of the United States; and it would be difficult to install loading coils on overhead lines here. The labour-saving devices shown by the author should prove useful here also, and the use of overhead cable also appealed to him.

Mr. A. Gibbon, discussing practical details, said that vitrified clay conduits were embedded in concrete as an insurance against external injury; self-aligning ducts had been laid here successfully without concrete. He showed some views of work on a line of 56 ducts at Ludgate Hill, illustrating the difficulties met with owing to the presence of numerous pipes, &c.

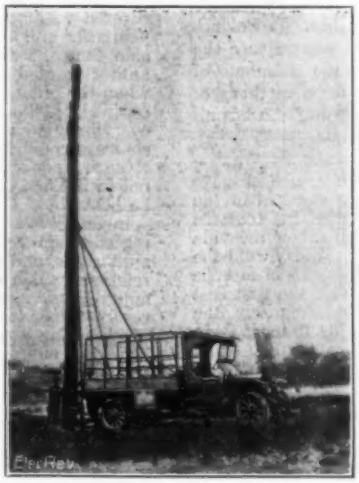
Mr. J. M. Shackleton said that in British practice earth wires were not now used on pole arms, and they might perhaps be dispensed with altogether. Poles were not planted here at the rate attained in the United States. He pointed out that single-way ducts enabled the formation of a nest of ducts to be varied to avoid obstructions. A satisfactory leading-in cable had not yet been devised.

Mr. Frank Gill said that glass insulators were used all over North America and in other parts of the world; in some parts of the United States the climate was as bad as in this country. American glass insulators worked well in France during the war, and were worth studying for use here. Aerial cables must have a suitable sheathing—not pure lead.

Sir William Noble considered that the paper would have valuable effects if the companies that laid cables would adopt the labour-saving devices described by the author. He was inclined to doubt some of the figures given for the rate of jointing and erecting poles. The use of large overhead cables in the United States was noteworthy, but there the engineers had runs of many miles without trees or other obstructions; here the roadsides were frequently bordered with trees, and many towns and villages were traversed, so that it was better and more economical practice to lay the cables underground. Labour-saving machines had been tried here, but gave disappointing results; a gang of labourers could do the work more cheaply.

Mr. J. E. Kingsbury, referring to the statement that the American Telephone & Telegraph Co. controlled about 12,600,000 telephone stations, explained that so far as concerned the associated companies, the "control" was technical not financial. Obviously it was impossible to connect up other companies' systems unless their lines and equipment were maintained at the same standard of efficiency as those of the company.

Mr. Byng, in reply to the discussion, insisted on the accuracy of the figures given for the rate of work, which he had per-



Motor truck with Derrick, lowering 45-ft. pole into hole.

Pole Erection.

Hole excavated by earth borer in stony subsoil; and fleet of transport vehicles

Hole Excavation.

sonally verified. The high speed was due partly to the efficient training of the jointers' mates. He had timed a "pair" jointed in 20 seconds; 150 joints were made in an hour, and 175 could be attained. It was found impossible to reach such high speeds in this country, though if it could be done the same wages would gladly be paid (an American jointer was paid $1 an hour, say, 6s.). He had seen a hole bored by the machine in four minutes, and the pole erected in two minutes.

Cable Vault at Exchange, showing Racks for Supporting Cables.

The use of unsightly poles in the United States was due to the low cost of local timber. Here the poles had to be imported, at considerable cost, which enabled them to stipulate for straight and knot-free poles.

THE ART OF SALESMANSHIP.

The first of the series of lectures organised by the British Electrical Development Association, for the discussion of the various phases of electrical salesmanship, was held at the rooms of the Chartered Institute of Patent Agents, London, on October 18th. Mr. S. T. Allen (the president of the I.M.E.A.) occupied the chair.

The Chairman, opening the proceedings, pointed out that the meetings were to be quite informal. The conferences, he said, had for their object the bringing together of persons interested in the sale of electricity or electrical material and appliances, and the promotion of discussions dealing with the various aspects of load building and salesmanship. It was not intended that the conferences should in any way replace the work of existing organisations for discussing the technique of the business, but that they should concentrate on methods of popularising the use of electricity, and presenting the advantages of electrification to the consuming public.

A paper was then read by Mr. E. H. Freeman on "Salesmanship in Wiring and Installation Work," in which he gave some valuable information and hints to those engaged in the solicitation of orders for this work. He limited his remarks to the case of the smaller user, *i.e.*, the occupant of the villa with a rent of from £50 to £100 per annum. To-day, said the author, no one seriously disputed the pre-eminence of electric lighting; the only effective objections raised were the first cost of the installation, and, less frequently, and less definitely, the higher working cost. Canvassers should be able to meet these objections, and should not be discouraged because they exist. Most of the larger houses were probably already converted to electric lighting, but in the case of the smaller houses a further complication existed, because so many of them were not owned by the occupants. An endeavour should be made to ascertain where the tenants had become the owners, and then to approach them with regard to wiring. Architects were convinced of the superiority of electric lighting, and therefore the arguments which might be used with the owner would be equally effective with the architect, who would usually be the medium for transmitting them to the owner of a new house. The author classified the usual objections to electric lighting installations under three heads, namely: (1) capital cost; (2) in the case of old houses, the anticipated damage to decorations and the general disturbance; and (3) the supposed heavier running costs. The first was undoubtedly the most important and most difficult, but it was desirable to persuade the owner to look at the matter from other points of view than that of the cost. Electric lighting installations would probably not involve an extra expenditure of more than 2 or 3 per cent. of the cost of the house. The canvasser should have sufficient knowledge of the value of the house under consideration, and of the approximate cost of the wiring, and another point to which attention might be given was that of labour saving. Once the possibility had been considered by the house owner further arguments could be introduced, such as that of the saving which would be effected on re-decorating. If the canvasser could collect actual examples in his own neighbourhood he should certainly do so. In one example, with which he was familiar, it was found that the whole cost of the wiring was more than covered within three or four years by the saving effected in re-decoration. One such example, with actual figures, would carry more weight than an hour's general talking. There were other arguments, such as that of general convenience. The ability to switch on a light without fumbling for matches was always deserving of mention, particularly if the more extensive use of two-way switch controls were put forward. The use of a gas by-pass might be mentioned as a counter argument, but this entailed an appreciable consumption of gas in a year. The absence of dirt and smell, and the fact that electrical apparatus could be used in any room required should be emphasised. By this time the prospective consumer should be getting sufficiently interested to want more definite details of cost, and in this connection it was a great mistake to suggest too low a cost. The canvasser should consider how much he could possibly persuade the consumer to buy, and include everything he thought ought to go in. He should include two-way switch controls for the staircases and the hall, and possibly for bedrooms; recommend extra plugs, &c. Such items could be cut out later if the cost was really prohibitive, but first the canvasser should try to get them considered. It was much better to let the purchaser cut them out if he insisted than to let him adopt a cheap, and possibly incomplete, scheme, and then add the extra items one by one. He would in the long run be better satisfied with a scheme that might cost £50, and was ultimately cut down to £45, than he would with one quoted at £20, eventually running up to £40. As to damage to decorations, the author had found a short sample of surface wiring material in his pocket to be a great help in some cases. A foot length of wood casing or twin lead wire neatly painted white, which could be placed against a door frame, or along a skirting board, so that its inconspicuousness could be demonstrated, was often a very convincing argument. Other samples, such as a sunk switch recessed into a wood block for the more important rooms, also had their value. The owner's convenience was also to be considered when carrying out the installation work. The objection with regard to supposed heavier running costs was, except in a very few districts, a futile objection, and most canvassers could easily obtain a few examples of costs of lighting by gas and electricity, which should convince any prospective customer. Having met the usual objections raised, other arguments included the reduced risk of fire; the entire removal of all possibility of explosion; general convenience; comparative economy and simplicity of maintaining lamps instead of mantles, and their longer life. As soon as a telling argument was found for the particular customer emphasis should be given to it and kindred points. Although the canvasser need not have any intimate knowledge of actual wiring work he should have a general knowledge of the subject. The relative advantages of tubing, casing, and lead-covered wiring; the amount of light required for a room; the points for and against lighting by pendants, brackets or portable lamps, were all matters he should study. Finally, the author pointed out that the canvasser's job was not finished when the order was booked, or even when the installation was complete. Periodical visits should be made to ensure that everything was satisfactory, and, if possible, a maintenance contract could be fixed up for a yearly test and examination. Even if only a nominal charge were made for this, which did not in itself pay, it was good business, as further orders could be booked.

In the discussion which followed a great deal was said with regard to the relations between wiring contractors and supply authorities, and a number of speakers testified to the friendly relations which existed between the two as a rule, although appeals were made for more co-operation and sympathy. With regard to canvassing householders in new roads, the difficulty of obtaining a sufficient number of consumers to justify the laying of supply mains was referred to. Whilst some contractors asked for more help from the supply authorities in this connection, the representatives of supply authorities pointed to the financial position, reminding the contractors that unless they were able to foresee that a reasonable number of householders would take electricity it was not feasible. The Chairman himself pointed out that canvassers should make themselves acquainted with the position of existing mains, and with the methods of the supply authorities. Another speaker said that too much must not be left to the contractors with regard to new roads, because whereas they would get a comparatively small profit from wiring premises, the supply authorities were getting a greater benefit, in that there would be a perpetual income.

A point raised by Mr. H. T. Young, a contractor, was that when a prospective customer had been given an estimate for wiring he would go to other contractors and get a lower estimate. The result was that the job would be done cheaply, the

house probably wired with flexible cord, and there was risk of fires. This led him to draw attention to the methods of insurance companies, which passed jobs that were really dangerous. The only real way to get over the difficulty was to register contractors, or to make the rules of the Institution of Electrical Engineers compulsory, and he asked that something might be done in this direction.

A speaker suggested that there might be two or three standard grades of wiring. With the cheaper grades the contractors who did the wiring should follow it up and see that it did not get so worn as to be dangerous.

The suggestion with regard to getting a prospective customer to consider as much apparatus as possible, and then cut it down if necessary, was questioned by one speaker, whose experience was that if a man were willing to have two or three lights in his drawing room, and make provision for further lights, that gave the canvasser a right to see him again, and gradually build up a load. If, on the other hand, the canvasser wanted to install too much, the customer would become suspicious.

Many schemes which had been adopted by canvassers were recounted. For instance, a representative from a borough near London said that the whole borough was divided into three sections, each section having its own representative. They concentrated at first on increasing the number of consumers on existing mains. The literature prepared by the E.D.A. was used, and each prospective consumer periodically received a pamphlet. Each house had a card, which contained information as to the method of lighting used, the approximate cost of that method of lighting, &c. It was useless to go from door to door without first creating interest by sending out suitable literature.

Mr. W. A. Gillott (Jackson Electric Stove Co.) described how he had furnished a house, had it wired, and fitted up with electrical apparatus, and given a practical demonstration of what electricity could do. It was necessary to let a man handle the class of goods one wished him to get familiar with. It was shown that a successful canvasser must be technical, have a keen commercial sense, and a good knowledge of general economics. He must not tell a householder that a certain apparatus would cost a certain sum for so many hours; he must talk in averages, and give the customer an idea as to how much it would cost per week. He must have regard to his competitors, and, if possible, learn their methods.

One suggestion which met with general approval was that of organised advertising on behalf of the industry as a whole through the E.D.A. If the Association were supported it could carry on a publicity campaign in the daily Press, and insert large advertisements periodically. The opinion was expressed by one or two speakers that circularising did not pay, and in one case a showroom had been opened, but had to be closed down for the same reason. The business did not come to the contractors in the same way as in other industries. As to the literature issued by the E.D.A., which was regarded as valuable, representatives were advised to read it and memorise it, as well as sending it out to prospective customers, so that they would always be up-to-date.

At the close of the discussion Mr. J. W. Beauchamp said the Association had been selling a great deal of literature, and he would be pleased to send samples from stock to any applicant. He also wanted the literature to be looked upon as a sort of guide to canvassers.

THE PACIFIC CABLE BOARD.

Annual Report.

The report of the Board for the year ended March 31st, 1921, shows that the surplus receipts have been employed in strengthening the reserve and renewal fund, and in improving staff superannuation arrangements. The receipts amounted to £633,343; the net traffic receipts (£620,051) fell short by £22,896 of those of the previous year, but the decrease was not so considerable as was anticipated, due mainly to the fact that the cable facilities by other routes were curtailed for several long periods during which the Board's route carried the whole or the major portion of the Australasian business. There was, however, towards the end of the year, a pronounced falling off in the total volume of traffic. In consequence a sufficient margin of carrying capacity was created to enable the Board to reinstate the cheap week-end service.

The expenditure, £543,171 (excluding special appropriations), exceeded that of the preceding year by £33,314, and the gross assets of the reserve fund on March 31st, 1921, amounted to £1,487,338.

The Sydney-Auckland cable was out of commission for a day, and the cable between Bamfield and Victoria was interrupted from November 27th to December 19th, 1921.

Neither interruption had any serious effect upon the traffic, since alternative routes were in each case available.

One of the Board's senior electricians, Mr. K. C. Cox, has spent much time in perfecting several important inventions. The Board pays royalties for the use of Mr. Cox's patents, and in addition recently granted him a gratuity.

For several reasons the Board considers that the duplication of the Pacific Cable has become a matter of urgency.

Various projects for carrying out the desired duplication have been examined by the Board. Definite proposals were made which could be carried into effect without any financial assistance from the Partner Governments as the Board's reserve fund is now capable of providing the necessary resources. The scheme has received the approval of some of the Partner Governments, and the Board hopes that their unanimous assent may be obtained at an early date.

The landlines in Canada leased by the Board from the Canadian Pacific Railway Co. worked well during the year. Leases of the lines between Montreal and Bamfield and between Vancouver City and Victoria, have been renewed for a further period of 10 years without any material alteration in the general terms. Through working between Halifax and Bamfield for traffic served by the Imperial Cable has continued throughout the year with complete success.

The service on the landline between Melbourne and Sydney, which is operated by the Board's staff, was generally satisfactory throughout the year.

An extensive building programme has been undertaken on Fanning Island, the cost of which is estimated at £12,000.

The new offices at Sydney were expected to be available for the Board's occupation in October, 1921.

The Board's cable maintenance vessel *Iris* was not called upon to undertake any repair operations on the Board's system during the year, but she was commissioned on four occasions under charter to other Administrations.

During the year under review the Hon. Sir Thomas Mackenzie, G.C.M.G., who had been a member of the Board since October 1912, and the Right Hon. Andrew Fisher, P.C., whose association with the Board dated back to February 1916, retired from their respective offices of High Commissioners for the Dominion of New Zealand, and the Commonwealth of Australia, and their places on the Board were taken by Colonel the Hon. Sir James Allen, K.C.B., and Mr. M. L. Shepherd, I.S.O., respectively.

During the year over 7,700,000 paying words of International traffic (*i.e.*, traffic other than local traffic between Australia, New Zealand and the Pacific Islands) were handled. This was approximately 1,350,000 words less than the total during the previous year, when more than 9,000,000 words were carried. In addition to the international traffic, approximately 2,600,000 paying words were carried during the year between Australia and New Zealand and between those Dominions and the Pacific Islands. This was approximately 280,000 words in excess of the 1919-20 figure. The ordinary international traffic showed a decrease of more than 500,000 words, while the deferred ordinary and the Press traffic each showed an increase of more than 300,000 words. There was a diminution of nearly 1,200,000 words in the Government traffic, the total handled being less than half that transmitted during the previous year.

The service of week-end telegrams between the United Kingdom and Canada on the one hand and Australia and New Zealand on the other was reinstated early in 1921. This class of traffic is carried across the Atlantic by the Imperial Cable only, the other Atlantic cable systems not having reintroduced the service yet. The only pre-war services which had not been reinstated at the end of the year were:—The deferred ordinary service between the United States and Australia and New Zealand, and the deferred Press service between the United Kingdom and Canada on the one hand and Australia and New Zealand on the other.

The Board made arrangements to reinstate the deferred Press service from August 1st, 1921, and it hopes in the near future to be able to re-introduce the deferred ordinary service with the United States.

The tariffs by the Board's system for traffic exchanged between the principal Continental countries and Australasia have been assimilated to those by other routes. Previously the Board's rates were generally higher.

"A Tug of War."—A correspondent writes:—"I was recently present at a perfectly delightful verbal contest. The two principals were local scrap-metal merchants, one a Jew, the other a Welshman. A large Government factory was being sold piecemeal, and some of the "lots" were valuable electric cables that traversed underground conduits connecting various parts of the factory. By mischance the ends of one length, about 300 ft., had been marked with different lot numbers. After bidding savagely against one another the Jew become the possessor of one end, whilst the other was knocked down to the Welshman. The rivals now turned their attention to the task of extracting the cable by attaching wire ropes to the ends and hauling on a winch; intervening buildings obscured the view of the parties. A tug of war was soon in progress, and both parties strained at their winches, but, naturally, the cable would not budge. Then the Welshman's wire rope parted, and a new one had to be fitted.

The Jew, delighted at the sudden release, spurred his men to fresh efforts, and the cable was out in no time. Meanwhile the Welshman had fitted the new rope and prepared to fasten it to his end of the cable, but lo! it had vanished! Fifteen seconds later he had found it. The verbal contest was thrilling."

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

28,897. "Electric transformers." H. A. T. Packford. October 31st.
28,922. "Alternating-current electric signalling devices." L. J. Rich. October 31st.
28,927. "Electric water-heaters." H. E. P. Baden and Electro Heater Co. October 31st.
28,929. "Electric irons." J. Wilson. October 31st.
28,935. "Electric connection plugs and sockets." A. E. Brewerton. November 1st.
28,963. "Bracket arm hangers for supporting trolley, &c., electric wires." A. T. Craston and S. T. Quilliam. November 1st.
28,984. "Electro-magnet for magnetising permanent V magnets." A. T. Scorey. November 1st.
28,985. "Switch for changing from parallel to series two electrical windings or lamps." A. T. Scorey. November 1st.
29,001. "Electric inspection lamps." Bi-Jet Co. and F. L. Sharpe. November 1st.
29,010. "Closed circuit relays." Siemens & Halske Akt.-Ges. November 1st. (Germany, December 11th, 1920.)
29,017. "House service, &c., fuse boards." Callender's Cable & Construction Co., Ltd. November 1st.
29,022. "Thermionic valves." W. R. Bullimore. November 1st.
29,084. "Fittings and couplings for electric conduits." B. L. Myer. November 2nd.
29,091. "Telephone system for railway trains." H. W. Hudson. November 2nd.
29,099. "Electric terminal." J. E. Nelson. November 2nd.
29,116. "Means for audibly signalling upon sounds being reproduced in a telephone receiver." F. W. Hampshire. November 2nd.
29,117. "Electric heating arrangement." I. J. Moltke-Hansen. November 2nd. (Norway, November 3rd, 1920.)
29,129. "Controller gear of electric tramcars, &c., for sanding the rails." J. F. Smith. November 2nd.
29,138. "Electric batteries." C. Kendall and Three Star Accumulators, Ltd. November 2nd.
29,139. "Storage batteries." F. C. Grund and Three Star Accumulators, Ltd. November 2nd.
29,140 "Batteries for miners' lamps, &c." C. Kendall and Three Star Accumulators, Ltd. November 2nd.
29,142. "Telephone systems." J. E. Pollak (Siemens & Halske Akt.-Ges.) November 2nd.
29,143. "Electric heating devices." R. E. Dickinson. November 2nd.
29,164. "Electric-spark indicators." L. Poulsen & Co. November 2nd. (Denmark, September 1st.)
29,165. "Wireless receiving systems." Ges. fur Drahtlose Telegraphie. November 2nd. (Germany, November 24th, 1920.)
29,167. "Arrangement of antennæ for influencing high-tension conductors, &c." Dr. E. F. Huth Ges. and K. Schwarz. November 2nd. (Germany, November 2nd, 1920.)
29,180. "Power generators." E. C. Collins and E. S. Grece. November 2nd.
29,224. "Electric switches." T. McClelland. November 3rd.
29,245. "Brake mechanism for electric lifts, &c." O. Ellefsen. November 3rd.
29,256. "Electrical intercommunication telephone sets." J. A. Romer. November 3rd.
29,269. "Compression device for transformer windings." Allmanna Svenska Elektriska Aktiebolaget. November 3rd (Sweden, March 8th.)
29,292. "Submarine signalling." R. A. Fessenden. November 3rd. (United States, March 23rd, 1918.)
29,309. "Circuit-breakers, switches, &c., for ignition systems for internal-combustion engines." R. F. Cerrito. November 3rd.
29,310. "Means for varying intensity of illumination of road-vehicle electric lamps." J. H. Runbaken and W. Torrance. November 3rd.
29,312. "Sparking plugs." J. H. Runbaken and W. Torrance. November 3rd.
29,321. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampen-fabrieken. November 3rd. (Holland, November 10th, 1920.)
29,322. "Manufacture of ionic valves." Naamlooze Vennootschap Philips' Gloeilampen-fabrieken. November 3rd. (Holland, November 10th, 1920.)
29,327. "Resilient rods or shafts for cleaning tubes, &c., laying electric conductors, &c." E. A. Ward. November 4th.
29,330. "Combined electric heating radiator and fan." F. Barber. November 4th.
29,351. "Electrically-controlled locks." W. E. Knorr. November 4th.
29,381. "Connecting-devices for electric conductors." A. H. Tadman. November 4th.
29,388. "Means for supporting telephone transmiters, &c." E. A. Graham. November 4th.
29,389. "Adjustable electric resistanecs." E. A. Graham. November 4th.
29,390. "Electric motor-driven diaphragm horns." E. A. Graham, A. C. Brocklies, and W. J. Rickets. November 4th.
29,394. "Coupling for tramcars, mining trucks, &c." J. Williams. November 4th.
29,395. "Apparatus for cooking wafers, &c., electrically." Carr & Co., Ltd., and R. Greenwood. November 4th.
29,408. "Ventilating systems for dynamo-electric machines." L. Dunker. November 4th.
29,414. "Arc lamps, &c." H. C. H. Braun. November 4th.
29,418. "Oil indicators of internal-combustion engines for controlling ignition circuit." A. G. Benstead and Rotax (Motor Accessories), Ltd. November 4th
29,428. "Wireless transmitting systems." P. O. Penersen. November 4th. (Denmark, November 18th, 1920.
29,429. "Means for indicating presence of fire-damp, &c." Ges. fur Drahtlose Telegraphie. November 2nd. (Germany, November 24th, 1920.)
29,431. "Impulse-transmitters for automatic, &c., telephone systems." J. Berry and Siemens Bros. & Co., Ltd. November 4th.
29,439. "Sparking plugs." G. Hoile and London & Hull Shipping Co., Ltd. November 4th.
29,446. "Electrically-driven vehicles." G. Meyfarth and Soc. Anon. des Ateliers de Secheron. November 4th. (Switzerland, November 30th, 1920.)
29,467. "Device for packing and carrying bulbs for wireless telegraphy." A. Astley. November 5th.
29,483. "Electric water-heater." T. R. Creffeld November 5th.
29,489. "Miners', &c., electric lamps." E. A. Hailwood. November 5th.
29,490. "Miners' &c., electric lamps." E. A. Hailwood. November 5th.
29,491. "Electric lamps." E. A. Hailwood. November 5th.
29,510. "Printing from electrotypes." E. Boudreaux. November 5th, (France, November 5th, 1920.)
29,512. "Stator and rotor alternating-current synchronous motor." F. Cortell. November 5th.
29,515. "Protective devices for electric circuits." G. E. Gittins. Metropolitan-Vickers Electrical Co., Ltd., and J. S. Peck. November 5th.
29,520. "Enabling railway running rails to be utilised as current rails." H. W. Jackson and E. Scutt. November 5th.
29,528. "Electrically-operated stippling-pens." F. C. Adams. November 5th.
29,536. "Machine for shaping combustible cores of ignition devices." H. Grossmann. November 5th. (Switzerland, June 6th.)
29,545. "Voltmeters and ammeters." A. Chinn. November 7th.
29,558. "Portable electric lamps." W. R. Crowe. November 7th.
29,559. "Dynamo-electric machines for electric lighting sets for motor vehicles, &c." H. Foxton. November 7th.
29,579. "Commutators of electric ignition systems." A. H. Caley and P. S. Talbot. November 7th.
29,581. "Lightning, &c., arresters for electric conductors." W. D. Owen and Reyrolle & Co., Ltd. November 7th.
29,587. "Means for magnifying effects of small efforts for telegraphy, &c." A. Orling. November 7th.
29,614. "Electric lighter." L. Lorrain and R. Vinolto (Lorrain). November 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

32,834. "Traction systems for elevated cable ways." R. E. Phillips (S. A. Rogers). September 30th, 1920. (170,602.)

1920.

10,304. "Radio-telegraphy signalling systems." W. J. Mellersh-Jackson (A. Taylor). April 12th, 1920. (170,605.)
11,277. "Telephone sets." Dictograph Products Corporation. August 21st, 1917. (142,126.)
11,842. "Electric switch fuses." W. A. Legge. April 29th, 1920. (170,612.)
12,263. "Electrodes for electric batteries and accumulators." A. Pouchain. May 3rd, 1920. (170,614.)
12,264. "Negative electrode for electric accumulators." A. Pouchain. May 3rd, 1920. (170,615.)
12,947. "Electric glow discharge lamps." H. Filippo, D. Lely, jun., and Naamlooze Vennootschap Philips' Gloeilampenfabriken. June 30th, 1919. (145,400.)
14,500. "Electric accumulators." A. Pouchain. May 27th, 1920. (170,618.)
15,935. "Electrical power transmission systems." A. M. Taylor. June 12th, 1920. (Patent of addition not granted. Cognate applications 17,490/20, 22,617/20, 28,923/20, 31,150/20 and 2/21.) (170,619.)
16,430. "Vacuum electric discharge apparatus having an incandescent cathode." Siemens & Halske Akt. Ges. May 31st 1916. (145,421.)
16,912. "Construction of commutators." R. Bosch Akt. Ges. April 29th. 1919. (145,528.)
17,356. "Method of and apparatus for directive sound transmission." Steward-Davit and Equipment Corporation. June 25th, 1919. (146,189.)
17,357. "Devices for detecting and determining the direction of sounds." Steward-Davit and Equipment Corporation. June 25th, 1919. (146,190.)
17,358. "Method of sounding and determining distances." Steward-Davit and Equipment Corporation. June 25th, 1919. (146,191.)
17,360. "Directive reception of sound or other wave energy." Steward-Davit and Equipment Corporation. June 25th, 1919. (146,193.)
18,244. "Arrangement for the excitation of continuous current generators in Ward Leonard systems." F. Krupp Akt. Ges. January 6th, 1915. (146,311.)
18,462. "Telephone exchange systems." Western Electric Co., Ltd. December 29th, 1916. (146,425.)
19,647. "Apparatus for the determination of wave energy direction." Steward-Davit and Equipment Corporation. June 25th, 1919. (147,669.)
20,237. "Vehicle stations for wireless telegraphy." Dr. E. F. Huth Ges. December 4th, 1914. (148,323.)
20,358. "Sending or receiving device for subaqueous sound waves." Signal Ges. September 17th, 1917. (Addition to 147,935, modified by 148,411.) (148,413.)
20,360. "Electro-magnetic subaqueous sound producer or receiver." Signal Ges. July 11th, 1918. (Addition to 147,935, modified by 148,411 and 148,413.) (148,415.)
20,505. "Bow collectors for electric vehicles." C. Conradty (firm of). June 17th, 1918. (148,528.)
20,508. "Bow collectors for electric railways in which the slip-piece is adapted to turn upon its longitudinal axis." C. Conradty (firm of.. April 28th, 1916. (148,531.)
20,784. "Insulation and support of thermionic valve electrodes between which a high potential difference exists." A. K. Macrorie, H. Morris-Airey, G. Shearing, and S. R. Mullard. July 10th, 1920. (170,634.)
21,382. "Reception of wireless signals," Marconi's Wireless Telegraph Co., Ltd. July 28th, 1919. (149,282.)
21,873. "Electric welding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 21st, 1920. (170,643.)
21,958. "Electric batteries." E. Alber. July 26th, 1919. (149,351.)
22,007. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. (A. N. Goldsmith). July 22nd, 1920. (170,656.)
22,058. "Automatic controlling means for the ignition timing in internal-combustion engines." C. K. Edwards, D. E. Batty, and Associated Equipment Co., Ld. July 23rd, 1920. (170,658.)
22,131. "Dynamo-electric machine group." R. L. Cleaver. July 24th, 1920. (170,663.)
23,142. "Transmission of power in and to the electrical equipment of motor vehicles, aircraft, and the like." F. H. Bowman and R. L. Aspden. August 6th, 1920. (170,692.)
23,480. "Means for charging portable electric accumulators." A. H. Railing and A. E. Angold. August 11th, 1920. (170,701.)
24,311. "Electric switches." F. Zuckschwerdt. August 20th, 1920. (170,724.)
24,425. "Method and apparatus for the measurement of the temperature of electric cables." E. Fawsett. August 23rd, 1920. (170,728.)
24,438. "Amplifying systems for electric currents." British Thomson-Houston Co., Ltd. (General Electric Co.). August 23rd, 1920. (170,730.)
25,760. "Telephone desk sets." P. C. Burns. September 7th, 1920. (170,735.)
26,075. "Construction and regulation of electric arcs." F. von Schlegell. September 10th, 1920. (170,738.)
26,887. "Electrical resistances." J. L. Lafeuille. September 22nd, 1919. (151,609.)
26,904. "Electric switch devices." T. W. Rogers (Krupp Akt. Ges. F.) September 21st, 1920. (170,745.)
26,909. "Regulating systems for alternating current circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). September 22nd, 1920. (170,746.)
27,496. "Storage battery testers." J. L. Thompson. September 27th, 1920. (170,748.)
27,796. "Casings, mountings and connections for electrical instruments, such as ammeters." R. Amberton. September 30th, 1920. (170,751.)
28,514. "Electric junction box." R. Crust. October 9th, 1920. (170,756.)
28,853. "Suspension insulators for electric wires and cables." F. Rohde. October 12th, 1920. (Convention date not granted.) (152,345.)
35,710. "Junction boxes for electric cables." H. McCrudden and Callender's Cable and Construction Co., Ltd. December 20th, 1920. (170,784.)

1921.

669. "Construction of conductors for electrical machines." Bergmann Elektricitats Werke Akt. Ges. November 26th. 1917. (156,673.)
958. "Frames for the windings of electric resistances or heating elements." Widerstand Akt. Ges. fur Elektro Waerme-Technik. September 12th, 1918. (157,103.)
9,180. "Electric oscillation generator." L. Levy. March 29th, 1920. (160,799.)
10,701. "Control of alternating-current electric motors." Metropolitan-Vickers Electrical Co., Ltd. July 19th, 1920. (166,878.)
17,600. "Secret magnetic locks for electric battery lamps, more particularly for use in mines." F. J. Turquand. January 23rd, 1920. (Divided application on 17,077/20.) (170,809.)